

# Gujarat PG CET 2025 Aerospace Engineering (AE) Syllabus PDF

## Engineering Mathematics

**Linear Algebra:** Matrix algebra, Systems of linear equations, Eigen values and eigenvectors.

**Calculus:** Functions of single variable, Limit, continuity and differentiability, Mean value theorems, Evaluation of definite and improper integrals, Partial derivatives, Total derivative, Maxima and minima, Gradient, Divergence and Curl, Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

**Differential equations:** First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations and Laplace equation.

**Complex variables:** Analytic functions, Cauchy's integral theorem, Taylor and Laurent series.

**Probability and Statistics:** Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions.

**Numerical Methods:** Numerical solutions of linear and non-linear algebraic equations  
Integration by trapezoidal and Simpson's rule, single and multi-step methods for differential equations

## Flight Mechanics

**Atmosphere:** Properties, standard atmosphere. Classification of aircraft. Airplane (fixed wing aircraft) configuration and various parts. Pressure altitude; equivalent, calibrated, indicated air speeds; Primary flight instruments: Altimeter, ASI, VSI, Turn-bank indicator. Angle of attack, sideslip; Roll, pitch & yaw controls. Aerodynamic forces and moments.

**Airplane performance:** Drag polar; takeoff and landing; steady climb & descent; absolute and service ceiling; range and endurance, load factor, turning flight, V-n diagram. Winds: head, tail & cross winds.

**Static stability:** Stability & control derivatives; longitudinal stick fixed & free stability; horizontal tail position and size; directional stability, vertical tail position and size; lateral stability. Wing dihedral, sweep & position; hinge moments, stick forces.

**Special topic: Dynamic stability:** Euler angles; Equations of motion; Decoupling of longitudinal and lateral-directional dynamics; longitudinal modes; lateral-directional modes.

### **Space Dynamics**

Central force motion, determination of trajectory and orbital period in simple cases. Kepler's laws; escape velocity.

## **Aerodynamics**

**Basic Fluid Mechanics:** Conservation laws: Mass, momentum and energy (Integral and differential form); Dimensional analysis and dynamic similarity;

**Potential flow theory:** sources, sinks, doublets, line vortex and their superposition. Elementary ideas of viscous flows including boundary layers.

**Airfoils and wings:** Airfoil nomenclature; Aerodynamic coefficients: lift, drag and moment; Kutta Joukowski theorem; Thin airfoil theory, Kutta condition, starting vortex; Finite wing theory: Induced drag, Prandtl lifting line theory; Critical and drag divergence Mach number.

**Compressible Flows:** Basic concepts of compressibility, One-dimensional compressible flows, Isentropic flows, Fanno flow, Rayleigh flow; Normal and oblique shocks, Prandtl-Meyer flow; Flow through nozzles and diffusers.

**Wind Tunnel Testing:** Measurement and visualization techniques. Shock -boundary layer interaction.

## **Structures**

**Strength of Materials:** Stress and strain: Three-dimensional transformations, Mohr's circle, principal stresses, Three-dimensional Hooke's law, Plane stress and strain. Failure theories: Maximum stress, Tresca von Mises. Strain energy. Castigliano's principles. Statically determinate and indeterminate trusses and beams. Elastic flexural buckling of columns.

**Flight vehicle structures:** Characteristics of aircraft structures and materials. Torsion, bending and shear of thin-walled sections. Loads on aircraft.

**Structural Dynamics:** Free and forced vibrations of undamped and damped SDOF systems. Free vibrations of undamped 2-DOF systems. Vibration of beams. Theory of elasticity: Equilibrium and compatibility equations, Airy's stress function.

## Propulsion

Thermodynamics, boundary layers, heat transfer, combustion and thermochemistry.

**Aerothermodynamics of aircraft engines:** Thrust, efficiency, range. Brayton cycle.

**Engine performance:** ramjet, turbojet, turbofan, turboprop and turboshaft engines. Afterburners.

**Turbomachinery:** Axial compressors: Angular momentum, work and compression, characteristic performance of a single axial compressor stage, efficiency of the compressor and degree of reaction, multi-staging.

**Centrifugal compressor:** Stage dynamics, inducer, impeller and diffuser.

**Axial turbines:** Stage performance.

**Rockets:** Thrust equation and specific impulse, rocket performance. Multi-staging. Chemical rockets. Performance of solid and liquid propellant rockets.

Aerothermodynamics of non-rotating propulsion components such as intakes, combustor and nozzle. Turbine blade cooling. Compressor-turbine matching, Surge and stall.

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