

Lecture 1 - Course Intro & Historical development of flights

Lecture 2 - Early development of aircraft propulsive devices

Lecture 3 - Development of Jet propulsion for aircraft

Lecture 4 - Introduction to thermodynamics, Scope and method, Basic concepts: system, surroundings, property, intensive and extensive, state, equilibrium and state postulate, process, path and cycle

Lecture 5 - Quasi-static processes, zeroth law of thermodynamics and temperature, concept of energy and its various forms, internal energy, enthalpy

Lecture 6 - Specific heats at constant pressure and volume Work and heat transfers

Lecture 7 - Tutorial

Lecture 8 - First law of thermodynamics for closed systems

Lecture 9 - First law of thermodynamics for open systems/flow processes

Lecture 10 - Second law of thermodynamics, heat engines, refrigerators and heat pumps, Kelvin-Planck and Clausius statement of second law of thermodynamics

Lecture 11 - Reversible and irreversible processes, concept of entropy

Lecture 12 - Increase of entropy principle, third law of thermodynamics, absolute entropy, perpetual motion machines

Lecture 13 - Tutorial

Lecture 14 - Carnot cycle, Carnot principle, thermodynamic temperature scale

Lecture 15 - Exergy, availability and second law efficiency

Lecture 16 - Tutorial

Lecture 17 - Gas and vapour power cycles, Otto cycle, Diesel cycle, Dual cycle

Lecture 18 - Rankine cycle, Brayton cycle, Stirling and Ericsson cycles

Lecture 19 - Thermodynamic property relations, Jacobean and Legendre transformations, Maxwell's equations

Lecture 20 - Tutorial

Lecture 21 - Properties of gas and vapour mixtures

Lecture 22 - One-dimensional compressible flows, isentropic flows

Lecture 23 - Flows with friction and heat transfer, normal and oblique shocks

Lecture 24 - Piston-prop engines: Otto cycles; Ideal and Real cycles

Lecture 25 - IC Engines for aircraft application

Lecture 26 - Performance parameters of IC engines

Lecture 27 - Supercharging of aircraft IC engines

Lecture 28 - Tutorial: IC Engines

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[Lecture 33 - Ideal cycles for Jet engines](#)

[Lecture 34 - Ideal cycles for variants of jet engines](#)

[Lecture 35 - Tutorial](#)

[Lecture 36 - Fundamentals of Ramjets and Pulsejets](#)

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NPTEL : Jet Aircraft Propulsion (Aerospace Engineering)

Co-ordinators : Prof. A M Pradeep, Prof. Bhaskar Roy

- Lecture 1 - Introduction & Development of Jet Aircraft Propulsion
- Lecture 2 - How the Aircraft Jet Engines make Thrust
- Lecture 3 - Jet Engine Basic Performance Parameters
- Lecture 4 - Turbojet, Reheat Turbojet and Multi-spool Engines
- Lecture 5 - Turbofan, Turbo-prop and Turboshift engines
- Lecture 6 - Ideal and Real Brayton cycles
- Lecture 7 - Jet Engine Cycles for Aircraft propulsion
- Lecture 8 - Cycle components and component performances
- Lecture 9 - Tute-1
- Lecture 10 - Analysis of engine real cycles
- Lecture 11 - Tute-2
- Lecture 12 - Thermodynamics of Compressors
- Lecture 13 - Thermodynamics of Turbines
- Lecture 14 - Axial Compressors : two dimensional analytical model
- Lecture 15 - Cascade analysis; Loss and Blade performance estimation
- Lecture 16 - Free Vortex theory; Single-Multi-stage characteristics
- Lecture 17 - Tutes-3
- Lecture 18 - Elements of centrifugal compressor
- Lecture 19 - Centrifugal Compressor characteristics: Surging, Choking
- Lecture 20 - Axial flow turbines; Turbine Blade 2-D (cascade) analysis
- Lecture 21 - Multi-staging: Axial Turbine; Turbine Cooling Technology
- Lecture 22 - Radial Turbine Aerodynamics & Thermodynamics; Losses
- Lecture 23 - Tutes-4
- Lecture 24 - Types of combustion chambers: mechanism & parameters
- Lecture 25 - Pr. Loss, Combustion efficiency; Combustion intensity
- Lecture 26 - Practical combustion system ; Stability, Fuel injection
- Lecture 27 - Intakes for Powerplant: Transport / Military Aircraft
- Lecture 28 - Subsonic, Transonic, Supersonic Intake Designs
- Lecture 29 - Nozzle : fixed and variable geometry nozzles
- Lecture 30 - C-D nozzle and their uses
- Lecture 31 - Tute-5

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[Lecture 37 - Use of Ramjets and Pulsejets in Aircraft propulsion](#)

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[Lecture 41 - Tute-7](#)

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NPTEL : Turbomachinery Aerodynamics (Aerospace Engineering)

Co-ordinators : Prof. Bhaskar Roy, Prof. A M Pradeep

- Lecture 1 - Introduction to Turbo machines Syllabus, References and Schedules
- Lecture 2 - Axial Flow Compressors and Fans : Introduction to Compressor Aerothermodynamics
- Lecture 3 - A two dimensional analytical model :Cascade
- Lecture 4 - 2D losses in Axial flow Compressor Stage : Primary losses
- Lecture 5 - Tutorial 1 : Two Dimensional Axial Flow Compressors
- Lecture 6 - 3D Flows in Blade Passages, Secondary Flows, Tip leakage Flow, Scrubbling
- Lecture 7 - Three Dimensional Flow Analysis : Radial Equilibrium Concept
- Lecture 8 - Classical Blade Design Laws : Free Vortex and other Laws
- Lecture 9 - Three Dimensional Flow Analysis in Axial Flow Compressor
- Lecture 10 - Tutorial 2 : Three Dimensional Axial Flow Compressors
- Lecture 11 - Axial Compressor Characteristics: Single stage, Multi stage and Multi spool Characteristics
- Lecture 12 - Instability in Axial Compressors
- Lecture 13 - Inlet Distortion and Rotating Stall, Control of Instability
- Lecture 14 - Transonic Compressors and Shock Structure Models, Transonic Compressor Characteristics
- Lecture 15 - Axial Flow Compressor Design, Inter Spool Duct
- Lecture 16 - Design of Compressor Blades, Aerofoil Design (Subsonic, Transonic, Supersonic Profiles)
- Lecture 17 - Design of Compressor Blade: 3D Blade Shapes of Rotors and Stators
- Lecture 18 - Noise Problem in Axial Compressors and Fans
- Lecture 19 - Axial Flow Turbines: Introduction to Turbines Aerothermodynamics
- Lecture 20 - Axial Flow Turbines: Turbine Blade 2D (Cascade) Analysis
- Lecture 21 - Axial Flow Turbines: Work done, Degree of Reaction, Losses and Efficiency
- Lecture 22 - Axial Flow Turbines: Blade and Axial Flow Passages, Exit Flow Matching with Nozzle
- Lecture 23 - Tutorial 3 : Axial Flow Turbines
- Lecture 24 - Multi staging and Multi spooling of Turbine
- Lecture 25 - 3D Flow in Turbine: 3D Flow Theories, Free Vortex Theories etc.
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- Lecture 27 - Turbine Blade Cooling – Fundamentals of Heat Transfer, Blade Cooling Requirements
- Lecture 28 - Turbine Blade Cooling Technologies
- Lecture 29 - Turbine Blade Design: Turbine Profiles, Aerofoil Data and Profile Construction
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Lecture 16 - Pressure Measurement

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Lecture 18 - Air Speed Corrections

Lecture 19 - Altitude and ROC/ROD Measurement

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NPTEL : Aero elasticity (Aerospace Engineering)

Co-ordinators : Prof. C. Venkatesan

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NPTEL : Instability and Transition of Fluid Flows (Aerospace Engineering)

Co-ordinators : Prof. Tapan K. Sengupta

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NPTEL : Introduction to Propulsion (Aerospace Engineering)

Co-ordinators : Dr. D.P. Mishra

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NPTEL : Jet and Rocket Propulsion (Aerospace Engineering)

Co-ordinators : Dr. A. Kushari

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NPTEL : NOC:Space Environment and its Effects on Orbital Spacecrafts (Aerospace Engineering)

Co-ordinators : Prof. Soumyabrata Chakrabarty

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Lecture 4 - Interplanetary Magnetic Field (IMF), Co-rotating Interaction Regions

Lecture 5 - Coupling of Solar Wind to Earth's Magnetosphere and Ionosphere, Geomagnetic Storm, Geomagnetic Substorm and Geomagnetic Indices

Lecture 6 - Earth's Radiation Belt, Ring Current and South Atlantic Anomaly

Lecture 7 - Satellite Orbits, Geometry, Velocity and Period, Orbital Parameters and Orbital Perturbations

Lecture 8 - Different Types of Earth's Orbit for Useful Satellite Applications

Lecture 9 - Satellite Segments, Space segments, Mechanical Main Frames, Structures and Thermal Control System

Lecture 10 - Satellite Segments, Space segments, Mechanical Main Frames, Mechanisms, Propulsion System, Electrical Main Frame and Power System

Lecture 11 - Satellite Segments, Space segments, Electrical Main Frame, TT and C, Attitude and Orbit Control System and Payloads

Lecture 12 - Satellite Segments, Earth Segments, Receive-Only Earth Station, Transmit-Receive Earth Stations

Lecture 13 - Characteristics of Vacuum Environment, The Effects on Spacecraft, Extreme Temperatures, Exposure to Radiation and Outgassing

Lecture 14 - Vacuum Environment, Outgassing, Outgassing Mechanism and Transport of Outgassed Material

Lecture 15 - Outgassing of Spacecraft Materials, TML, CVCM, WVR and Its Significance, Ground Simulation of Vacuum Environment, Thermo-Vacuum Chamber, Thermo-Vacuum Test Philosophy and Characterization of TML, CVCM and WVR

Lecture 16 - Vacuum Environment, The Effect of Exposure of UV Radiation on Spacecraft Material, Design Guidelines and Mitigation Techniques

Lecture 17 - Neutral Gas Flow Around a Spacecraft, Effects on Spacecraft, Atomic Oxygen Attack, Sputtering, Contamination and Spacecraft Glow

Lecture 18 - Neutral Space Environment, Atmospheric Drag, Drag Force and Satellite Orbital Parameters

Lecture 19 - Neutral Space Environment, The Micrometeoroid/Orbital Debris Particulate Environment and Hyper Velocity Particle Impact on Spacecraft

Lecture 20 - Spacecraft Induced Neutral Environment, Scattering of Electromagnetic (EM) Radiation from Particles and Orbital debris

Lecture 21 - Orbital Debris, Dealing with Space Debris- Management, International Cooperation, Monitoring, Detection and Tracking, Radar Techniques and Optical Techniques

Lecture 22 - Capturing of Orbital debris, Contact capturing method, Contactless capturing method and Removal of Orbital debris

Lecture 23 - Removal of Orbital debris, Space Environment based and Non-space Environment

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Lecture 25 - What is plasma and its nature, Behavior of plasma in external Electromagnetic field, Uniform magnetic field, Gyro-radius and Cyclotron frequency

Lecture 26 - Charge particle movement in a uniform magnetic field, Helical particle trajectory, Guiding center, Pitch and pitch angle,

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Lecture 34 - Spacecraft charging, Spacecraft Equilibrium Potential, Repelling of Like Charges, Attraction of Opposite Charges, Boltzmann's Repulsion Factor and Spacecraft Potential in Plasma

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NPTEL : Introduction to Aerodynamics (Aerospace Engineering)

Co-ordinators : Dr. K.P. Sinhamahapatra

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NPTEL : Gas Dynamics (Aerospace Engineering)

Co-ordinators : Dr. T.M. Muruganandam

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Co-ordinators : Prof. M. Ramakrishna

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