

Wave Propagation in Continuous Media - Web course

COURSE DETAIL

Lesson No.	Topic
1.	Transverse Vibrations of Strings, Axial Vibration of Bars, Waves in a Fluid-filled Elastic Tube, Torsional Vibration of Circular Bars, Transverse Vibration of Beams
2.	Dynamics of Elastic Media, Acoustic Waves in Fluids, Surface Gravity Waves, Surface Waves on Shallow Water, Conservative Kinematic Models
3.	Maxwell's equations and material equations: Macroscopic Maxwell's equations, Material equations and LIH, The wave equation, Vector and scalar potentials
4.	First Order PDEs, General Solution of the Wave Equation
5.	d'Alembert's Solution, Fourier Transform Method for IVP
6.	Linear Waves in a Diffusive Medium, Nonlinear Waves with Diffusion
7.	Harmonic Waves and Dispersion Relation, Phase Velocity, Superposition of Harmonic Waves
8.	Dispersion, Group Velocity, Evolution of a Gaussian Wave Packet
9.	Wave solution of Maxwell's equations: Wave solution: Plane waves, Scalar Spherical waves, Cylindrical waves, Momentum and energy of the electromagnetic field
10.	Electromagnetic wave propagation: Superposition of Plane waves, Linear Polarisation, Circular and Elliptical Polarisation
11.	Boundary Conditions: BC for the normal components of the fields, BC for the tangential components of the fields
12.	Fresnel Equations: Laws of reflection and refraction, Electric field parallel to the plane of incidence, Electric field perpendicular to the plane of incidence



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13.	Waves in conductors and waveguides: Waves in conductors, Waveguides
14.	TM and TE modes: Rectangular Waveguides, Cylindrical waveguides
15.	Wave packets in dispersive media: Wave packets by superposition of sinusoidal wave, Phase and Group velocity, Various types of wave packets, Gaussian wave packets, Evolution of a Gaussian wave packet in a dispersive medium
16.	Forced Motion, Energetics of Wave Motion, Wave Impedance
17.	Reflection at a Boundary
18.	Scattering at a Finite Impedance
19.	Impulsive Start of a Bar
20.	Axial Collision of Bars
21.	Harmonic Waves in Beams, Scattering of flexural waves, Motion of Material Points of a Beam
22.	Integral transform method: The Fourier transform, The Sine transform,
23.	The Green Function: The Hankel transform
24.	Fresnel diffraction-Circular aperture: Fresnel half period zones
25.	The vibration spiral: Zone Plates, Circular obstacle and Poisson spot
26.	Fresnel Kirchhoff theory: Huygens-Fresnel theory, Kirchhoff theory
27.	Fraunhofer Diffraction: Fraunhofer approximation, Rectangular aperture
28.	Dispersion: Normal dispersion, Anomalous Dispersion, Elementary theory of dispersion
29.	Waves in Cartesian Coordinates, Waves in Polar Coordinates, Energetics of Membrane Waves
30.	Equations of motion, Plane Elastic Waves in Unbounded Continua
31.	Incident P-wave, Incident SV-wave, Incident SH-wave

32.	Rayleigh Surface Waves
33.	Planar Acoustic Waves, Spherical Waves, Energetics of Acoustic Waves
34.	Acoustic Radiation from a Vibrating Surface, Radiation from Membranes and Plates
35.	Waves in Wave Guides, Wave Guide with a Rectangular Cross-section, Wave Guide with a Circular Cross-section
36.	Solitary waves and Solitons: Solitary waves and Solitons, Non-topological and Topological solitons, Water waves
37.	Non topological Solitons-The KdV equation: Conservation Laws, Boussinesq equation
38.	Backlund transformation and multi-soliton solutions: Auto Backlund transformation, Liouville's equation, Auto-Backlund transformation for the KdV equation, Non-linear superposition and multi-soliton solution
39.	Topological Solitons-The Sine-Gordon equation: SG soliton and anti-soliton, Two soliton solution, SG Breathers, Conservation Laws, Backlund transformation
40.	The Fermi-Pasta-Ulam problem: The α and β couplings, α -FPU and Boussinesq equation, β -FPU and MKdV equation