Chapter 1. A Brief History

1.1 Introduction
Four main subjects : Reflection, Refraction, Wave, Quantum theory of light

1.2 In the Beginning
Early mirrors : Polished copper, bronze, speculum (copper with tin)

- Early theory (similar to ether theory) : Pythagoras, Democritus, Empedocles, Plato, Aristotle
  Rectilinear propagation was well known
  Law of reflection : Explained by Euclid in his book, 300 BC
  Hero : \textit{Principle of shortest path} to explain the both

1.3 The Seventeenth Century
Galileo 1564-1642 : Hand made \textit{telescope} with negative eyepiece
Snell 1621 : Empirical discovery of \textit{Law of Refraction}
(Start of modern applied optics)
Descartes 1596-1650 : Light as a pressure transmitted by an elastic medium
  \rightarrow \textit{Law of Refraction} in terms of sine functions.
Fermat 1657 : \textit{Principle of least time}
  \rightarrow Derivation of law of reflection
Grimaldi 1618-1663 : Observation of \textit{diffraction}
  \rightarrow Bands of light within the shadow of a rod under a small source
Hooke 1665 : Study of colored interference by thin films
  Light as a rapid \textit{vibratory motion} of the medium
  Luminous body generates a sphere
  (Beginning of the wave theory)
Newton 1642-1727 : Light was composed of colors
  \textit{Light corpuscles} of various colors excited the ether into
  characteristic vibrations
  No explanation to the rectilinear propagation
  \rightarrow Rejection of the wave theory
  Not possible to remove chromatic aberration of a lens
  \rightarrow Invention of reflecting telescope
Huygens 1629-1696 : Light slowed down in dense media
  (opposite to Descartes, Hooke, Newton)
  Derivation of laws of reflection, refraction, and
double refraction using \textit{wave theory}
  Discovery of polarization
Römer : Measurement of finite \textit{speed of light}
1.4 The Nineteenth Century
Young 1801-1803: Principle of interference
   → Explanation of the color fringes of thin films,
      Determination of wavelengths of colors)
Fresnel 1788-1827: Huygens’s wave description + Interference principle
   (A primary wave is formed by overlap and interference
      of the spherical secondary wavelets)
   → Explanation of diffraction and rectilinear propagation
Young: Transverse wave theory from experiments of polarization
Fresnel: Formulas for reflection and refraction
Fizeau 1849: The speed of light of 315,300 km/s
   (Toothed wheel and mirror at 8633m)
Foucault 1850: Less speed of light in water than in air
   (Contradictory to the particle theory)
Maxwell 1831-1879: Maxwell’s eqs.
   → The electromagnetic wave is transverse
      Its speed is same with the speed of light
Hertz 1888: Generation and detection of electromagnetic waves
Michelson and Morely: No relative motion between the Earth and ether

1.5 Twentieth Century Optics
Einstein 1905: Special theory of relativity
   → Rejection of ether (Light is a self-sustaining wave)
Planck: Quantum theory
Einstein 1905: Photon (quantum of radiant energy $h\nu$)
1950s: Concept of spatial frequency and Fourier transform
   → Image formation, evaluation, transfer function, spatial filtering

Thin film coating, Thin film waveguide, Fiberoptics, Infrared materials, Plastics in optics
Low thermal expansion glass ceramics
The first laser in 1960: New optical effects (Harmonic generation, frequency mixing …)
Crystal optics: SHG, Electro-optics. Acouto-optics
Holography: 3-D, Storage, Nondestructive testing
Optics in military: Smart bombs, Spy satellite, Death rays
Commercial lasers: Video player, Cutting tools, Type setting, Supermarket scanner,
   Surgery, LCD, Optical fiber