Subject:
In contemporary physics text books Huygens’ principle is not only used to explain the diffraction of light by a single slit, a double slit and a diffraction grating, but also the reflection and the refraction of a plane wave.

Deficiencies:
1. Huygens' principle (or the Huygens-Fresnel principle) is a simple mathematical tool for determining the interference pattern of two or more single waves. However, a particular principle is not needed in the case of the simplest and at the same time most important interference experiments. Even without Huygens' principle one will expect that a circular or spherical wave will emerge from a small opening (small compared with the wavelength) in an obstacle on which a plane wave is incident. There is no need for a new principle in the case that there are two or more such openings either. Moreover, there is no reason for a particular name “elementary waves” for the emerging circular waves. The principle is useful only when the slit is greater than the wavelength.

2. Also for the description of reflection and refraction Huygens’ principle is not needed, since it explains the behavior of a plane wave by that of circular waves. A function can be decomposed in many different ways: in harmonic components, in spherical harmonics, Bessel functions and many more. If such a decomposition is done, it is reasonable to chose a basic set of functions that takes into account the symmetry of the problem. Obviously this is not the case when decomposing a plane wave into "elementary waves", i.e. circular waves. The original wave, i.e. the plane wave has already the highest symmetry that a wave can have. Reflection and refraction are easily understood with plane waves. Using spherical or circular waves means to explain the simple by the complicated.

Origin:
The principle was formulated by Huygens in 1690 in his “Traité de la Lumières”. This was 100 years before the great age of wave optics which began with Fresnel and Young, and 150 years before the Electrodynamics of Faraday and Maxwell. In Huygens’ time the laws of reflection and diffractron were known, it was known that the velocity of light is finite, as well as the fact that light is composed of colored components. Why then was the principle at that time so important, and why did it keep its significance until today?

At Huygens' age another theory of the light existed already: The corpuscular theory, first advanced by Descartes and later by Newton. To this theory Huygens opposed his idea of light as a wave. The criterion for a good theory at that time was mainly its ability to explain refraction and reflection.

To explain meant (and still means today), to reduce a phenomenon to another one, that is taken for fundamental and thus not in need of explanation. However, since the time of Fresnel refraction and reflection do not need elementary waves as an explanation. When finally Maxwell showed that
light is an electromagnetic wave and described it mathematically Huygens’
elementary waves definitely became obsolete, even though it was not clear
why it should be valid for the complicated electromagnetic transverse
waves. Only Kirchhoff succeeded in showing the compatibility of Huy-
gens’ principle with the electromagnetic theory.

The role which Huygens’ principle plays today at the school and the Univer-
sity is still marked by its former importance. Just as Lenz’ law or Kepler’s
laws, it has survived its own more general follow-up laws. It is true that it
still is a useful method for an approximate determination of interference pat-
terns, but as such we should put it together with the many other tools of
physics and not call it a principle.

Disposal:

To explain the diffraction at the single slit and the interference pattern of the
double slit and the grating, no particular principle is needed. If one cannot
decide to let the treatment of the large slit to the university, then one may
introduce Huygens’ principle, but with a more modest demeanor.

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