Color Physics and Principle of Appearance

Undergraduate 3 credit course in Polymer Engineering curriculum

Amirkabir University of Technology

Chapter 1: Description of color, color perception, things required to see color (introduction of light, light sources, standard illuminants, spectral power distribution, black body radiator, color temperature, color rendering index).

Chapter 2: Light interaction with objects (description of specular reflection, gloss, light scattering, absorption, transmission, Beer-Lambert's law, the desert island experiment, description of Hue, Chroma, Lightness. spectral reflectance curves, spectrophotometers, how spectrophotometers work?, type of spectrophotometers).

Chapter 3: Color mixing (subtractive color mixing, additive color mixing, Grassman's laws).

Chapter 4: Color vision (visual system, color vision, trichromatic theory, opponent colors theory, color blindness, CIE standard observer, color matching functions).

Chapter 5: Colorimetric calculations and color spaces (calculation of tristimulus values, CIEXYZ color systems and its discrepancies, Munsell color-order system, CIELUV, CIELAB, colorimeters, color difference evaluation, visual color difference, one-dimensional color scales, whiteness, yellowness).

Chapter 6: Introducing some color physics phenomena (light adaptation, chromatic adaptation, color constancy, metamerism).

Chapter 7: Colorimetry of special materials (optical behavior and colorimetry of fluorescent materials, pearlescent pigments and metallic particles).

Chapter 8: 8. Introducing of color matching (spectrophotometric and colorimetric, Kubelka-Munk theory, introducing of single-constant and two-constant theories, basic calculations of spectrophotometric color matching).

References:

1. R. S. Berns, Billmeyer and Saltzman's Principles of Color Technology, 3th ed, John Wiley & Sons, 2000.
2. R. Mcdonald, Colour Physics for Industry, Society of Dyers and Colourists, 1997.
3. G. A. Klein, Industrial Color Physics, Springer, 2010.
4. N. Ohta, A.R. Robertson, Colorimetry fundamentals and applications, 1sted, Wiley, 2006.
5. G. Wyszecki, W. S. Stiles, Color Science: Concepts and Methods, Quantitative Data and Formulae, 2nd ed, 2000.
6. A.K.R. Choudhury, Modern Concepts of Color and Appearance, Science Pub Inc, 1999.