PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

OPTICAL SYSTEM DESIGN

Offered to : M.Sc.(PHYSICS)	Course Code : 22PH3D6
Course Type : Domain specific elective (DSE)	Course : Optical System Design
Year of Introduction : 2004	Year of offering : 2022
Year of Revision : 2022	Percentage of Revision : Nil
Semester : I	Credits : 4
Hours Taught : 60 hrs. per Semester	Max.Time : 3 Hours

Course Description:
Optical System Design course covers the basic knowledge of optics and the flow of light through an optical system. This course encompasses the various components of an optical system. The course discusses the simple components of an optical system, including its light, lens, oblique beams, and photophysical aspects.

Course objectives:
1. To learn and analyze the optical systems with ray tracing
2. To analyze optical systems for and make corrections
3. To judge the quality of optical systems by determining OPD, MTF and OTF
4. To learn the concepts of stops, apertures and different diffraction effects
4. To understand catadioptric systems

CourseOutcomes: Atthe endofthiscourse, studentsshould beable to:
CO1: Explain the concepts of optical systems with ray tracing
CO2: Analyze optical systems and eliminate aberrations corrections
CO3:Analyse different types of stops, apertures and diffraction effects
CO4:Analyse different parameters involved in wave optics
CO5: Explain different lenses, mirror and catadioptric systems

CO - PO MATRIX								
22PH3D6	CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
	CO1	M					L	M
	CO2	M					L	M
	CO3	M					L	M
	CO4	M					L	M
	CO5	M					L	M

Syllabus		
Unit	**Learning Units**	**Lecture Hours**
I	**First order Optics** Ray Tracing of paraxial ray, graphical ray tracing, trigonometric ray tracing at a spherical surface, Magnification and the Lagrange theorem, The Gaussian optics of a lens system, First order Layout of an optical system.	12
II	**Aberrations** Symmetrical Optical system, Aberration detection using ray trace data, Spherical aberration, surface contribution formulas, Zonal spherical aberration, Primary spherical aberration, Design of a spherically corrected achromat, coma and sine condition, The optical sine theorem, The abbe sine condition, Astigmatism and the coddington equations, The Petzval theorem, Curvature and distortion, Chromatic aberration, Chromatic of a cemented doublet, Contribution of a single surface to the primary.	12
III	**Stops, Apertures, Pupils and Diffraction** The aperture stop and pupils, The field stop, vignetting, glare stops, cold stops, baffles, the telecentric stop, apertures and image illumination – f number and cosine fourth, depth of focus, diffraction effects of apertures, Resolution of optical systems.	12
IV	**Wavefront aberrations and MTF** Optical path difference: Focus shift, Optical path difference: spherical aberration, aberration tolerances, image energy distribution (geometric), spread functions – point and line, geometric spot size due to spherical aberration, The modulation transfer function, Square wave Vs Sine Wave targets, spherical modulation transfer functions:diffracted limited systems, radial energy distribution, point spread functions for the primary aberrations.	12
V	**Mirro and Catadioptric systems** Comparison of lenses and mirrors, ray tracing a mirror system, single mirror systems, single mirror catadioptric systems, two mirror systems, multiple mirror zoom systems.	12

ReferenceBooks:

1. Kingslake, R., Optical System Design, 2nd Edition, Academic Press, 2010
2. Warren J Smith, Modern optical Engineering, 3rd Edition, McGraw Hill, 2000
3. Optical System Design, BiljanaTadic-Galeb, Paul Yoder, and Robert, E.Fischer, McGraw Hill Education, Second Edition, 2008
4. Principle of Optics, B.K.Mathur, Gopal Press, Second Edition, 1970