

1.	Title of the Course	Classical and Quantum Optics
2.	Course Number	PH6103
3.	Status of the Course	Core
4.	Structure of Credits	3-0-0-3
5.	Offered To	PG
6.	New Course/Modification to	New
7.	To be Offered by	Department of Physics
8.	To take effect from	July 2020
9.	Prerequisite	Nil
10.	Whether approved by the Department	Yes
11.	<p><b>Course Objective:</b> To provide fundamental concepts of classical and quantum optics and their application to physical systems and optical instruments such as interferometers, lasers, microscopes, optical tweezers, optical isolators, acousto-optic modulators and single photon counting modules. To help students understand and gain insight into theoretical and experimental aspects of optical phenomena such as dispersion, interference, diffraction, polarization, birefringence, coherence and imaging.</p>	
12.	<p><b>Course Content:</b> Fermat's principle, geometrical optics, matrix methods, composite systems, non-paraxial ray tracing, aberrations; Review of electromagnetic waves and Maxwell equations, dispersion, Fresnel relations; Superposition of waves: interference (division of amplitude and wavefront), diffraction (Fraunhofer and Fresnel); Polarization: birefringence, polarization ellipse, Jones matrices, Faraday effect, optical activity, acousto-optics, magneto-optics and electro-optics; Fourier optics; Coherence theory; Applications: Fabry-Perot interferometers, lasers, optical tweezers, microscopes; Quantization of electromagnetic field, coherent state and Fock state basis; Two-level atom in an electromagnetic field: spontaneous emission, Rabi oscillation; Correlations: field and intensity, photon anti-bunching, two-photon interferometry; Single photons: generation, counting; Squeezing and entanglement: homodyne and heterodyne detection.</p>	
13.	<p><b>Text book(s):</b>            1. Fox M, <i>Quantum Optics - An Introduction</i>, Oxford University Press (2009).            2. Hecht E and Ganesan A R, <i>Optics</i>, Pearson (2008).</p>	
14.	<p><b>Reference(s):</b>            1. Brooker G, <i>Modern Classical Optics</i>, Oxford University Press (2003).            2. Gerry C and Knight P, <i>Introductory Quantum Optics</i>, Cambridge University Press (2004).            3. Ghatak A, <i>Optics</i>, McGraw-Hill Education India Private Limited (2017).            4. Pedrotti F L, Pedrotti M L and Pedrotti S L, <i>Introduction to Optics</i>, Pearson Education India (2014).</p>	