AMITY UNIVERSITY
UTTAR PRADESH

Course Title: Optics and Lasers

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
3	1	4	0	6

Credit Units: 6

Course Level: PG **Course Code: TELE607**

Course Objectives: The aim of this course is to provide students the concepts of electromagnetic waves in the optical regime, including photons and light, and to study the phenomena such as interference, diffraction, polarization. It also includes the study of lasers and holography and their applications.

Pre-requisites: Physics and Basic Optics.

Course Contents/Syllabus:

	Weightage (%)
Module I : Review of basics of Optics: Reflection and Refraction	**10**
Descriptors/Topics : Laws of reflection and refraction, refraction by a single spherical surface, Reflection at an interface of two dielectrics, Reflection by a conducting medium, reflectivity of a dielectric film.	
Module II : Coherence and Interference	**25**
Descriptors/Topics : Superposition of waves, Michelson Interferometer, Mach Zehnder Interferometer, partial coherence, coherence time and coherence length, coherence and line width, optical beats, spatial coherence, intensity interferometer, multiple beam interference, Fabry-Perot Interferometer, theory of multilayer films.	
Module III : Diffraction and Fourier Optics	**25**
Descriptors/Topics : Fraunhofer diffraction: diffraction by different types of aperture, X-ray diffraction, self focusing phenomenon, spatial frequency filtering, Fresnel Diffraction: Zone plate, gaussian beam propagation, transition to fraunhofer region, Fourier Optics.	
Module IV : Polarization	**15**
Descriptors/Topics : Polarization of Light, phenomenon of double refraction, optical activity, analysis of polarized light, change in state of polarization, wollaston prism, faraday rotation, polarization devices.	
Module V : Lasers and Holography	**25**

Descriptors/Topics : Interaction of radiation with matter, light amplification and gain saturation. Laser rate equations, three level and four level systems; Optical Resonators, Q-switching and mode locking in lasers, Properties of laser radiation, some laser systems: ruby laser, He-Ne laser, CO_2 laser, Nd:Yag laser, fiber laser. Holography: Basic principle, coherence requirements, resolution, fourier transform holograms, volume hologram, applications of hologram.	

Student Learning Outcomes: After completion of course, students will be able:

- To demonstrate the advance knowledge of optical phenomena and their applications.
- To describe the working of lasers.
- To explain the various types of Laser and Holography and their Applications.
- To explain the Fourier Optics and its Applications.

To participate in the group discussion of different optical phenomenon.

Pedagogy for Course Delivery: Class Room Lecture, Tutorial, Group Discussion, Seminar and Lab Session.

Lab/ Practicals details, if applicable:

List of Experiments:

- To measure the wavelength of He-Ne laser with meter scale.
- Measurement of thread angle, pitch, and diameter of a screw.
- Study of Diffraction pattern of a single slit, double slit, square and circular aperture.
- To study spatial and temporal coherence.
- Determination of Gaussian Beam parameter.
- To study spatial frequency filtering.
- Verify the malus law.
- To study the Brewster angle.
- To study magnetooptic effect and magnetooptic modulation.
- To stydy electrooptic effect and AC modulation.
- Reconstruction of the image of hologram.

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**Total**
67%	33%	100

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	Class Test	Home Assignment	Seminar/Viva	Attendance	
Weightage (%)	10%	10%	5%	5%	70%

Lab/ Practical/ Studio Assessment:

	Continuous Assessment/Internal Assessment				End Term Examination		
Components (Drop down	**Performance**	**Viva**	**Attendance**		**Lab Records**	**Practical**	**Viva**
Weightage (%)	15%	10%	5%		10%	40%	20%

Text Reading & References:

- M. Born and E. Wolf, Principles of Optics, Macmillan, New York.
- Fourier Optics by Joseph Goodman, Tata McGraw Hill, (II Edition).
- A Yariv and P .Yeh, Optical Waves in crystals (Wiley, New York, 1984).
- A.K. Ghatak and K. Thyagrajan, Optical Electronics (Cambridge Univ., Cambridge Press, 1989).
- A Yariv, Quantum Electronics, 2nd edition (John Wiley 1975).