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

LASERS AND NON LINEAR OPTICS

Offered to : M.Sc.(PHYSICS)	Course Code : 22PH3D2
Course Type :Domain specific elective(DSE)	Course : LASERSANDNONLINEAROPTICS
Year of Introduction : 2022	Year of offering : 2022
Year of Revision : xxx	Percentage of Revision :xxx
Semester : III	Credits : 4
Hours Taught: 60 hrs. per Semester	Max.Time : 3 Hours

Course Description : Lasers and Non Linear Optics course provides an insight on the principles of lasers and their applications in various areas of science and industry. It also provides fundamentals of nonlinear optics and interaction of light with matter.

Course objectives:

1. Tounderstandtheprinciplesandoperationofvariouskindsoflasersandtheirapplicationsinvariousareasof scienceandindustry

2. Tounderstand different mechanisms which occur in laser

3. To learn fundamentalsofnonlinearopticsandinteractionoflightwithmatter

4. To learn the concept of holography imaging.

5. To learn the basics of fiber optics

CourseOutcomes: Attheendofthiscourse, studentsshouldbeable to:

CO1: Understand principles of laser physics and required threshold conditions.
CO2: Apply theprinciple to different laser systems.
CO3: Understand different phenomena of non linear optics
CO4: Understand the concepts of holography and its applications
CO5: Understand the propagation of light in different optical fibers.

CO-POMATRIX								
	CO-PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
22PH3D2	**CO1**	H					L	M
	CO2	H					L	M
	CO3	H					L	M
	CO4	H					L	M
	CO5	H					L	M

Syllabus		
Unit	**LearningUnits**	**Lecture Hours**
I	**PrinciplesofLasers** Introduction–directionality- brightness-monochromaticity-coherence–absorptionandemissionprocesses- the Einstein coefficients - amplification in a medium - laser pumping Boltzmann's principle and thepopulation of energy levels – attainment of population inversion - two level – three level and four levelpumping. Optical feedback: the optical resonator laser power and threshold condition confinement ofbeamwithintheresonator–stabilitycondition	12
II	**LasersandOpticalProcesses** Laseroutput-Absorptionandemission-shapeandwidthofbroadeninglines–linebroadeningmechanisms – natural, collision and Doppler broadening. Types of Lasers: Argon ion gas laser, Dye laser,Nd:YAGlaser,Semiconductorlaser,Applicationsoflasers.	12
III	**NonlinearOptics** Basic Principles- Harmonic generation – Second harmonic generation- Phase matching – Third Harmonicgeneration-Opticalmixing –Parametric generation oflight–Parametric lightoscillator-Frequency upconversion-Selffocusingof light.	12
IV	**Holography** Introduction to Holography-Basic theory of Holography-Recording and reconstruction of Hologram-Diffuse object illumination-Speckle pattern – Frenel and Fourier transform Holography - Applications ofHolography	12
V	**FiberOptics** Introduction – total internal refraction –optical fiber modes and configurations-fiber types – rays andmodes- Step index fiber structures – ray optics representation - wave equations for step indexed fibers –modal equation – modes in step indexed fibers – power flow in step indexed fibers. Graded indexed fiberstructure: Structure – Numerical aperture and modes in graded index fibers-Signal degradation in opticalfibers.	12

TextandReferenceBooks:

1. LaserandNon-LinearOptics,B.B.LAUD(NewAgeInternationalPublishers)
2. IntroductiontoModernOptics,GRANTR.FOWLES(DoverPubInc.).
3. LasersandtheirApplications,M.J.BEESLEY(TaylorandFrancis).
4. OpticalFiberCommunications, GERDKEISER(Tata McGraw-HillBook)