

COURSE TEMPLATE

1.	Department / Centre proposing the course	PHYSICS	
2.	Course Title (<i>< 45 characters</i>)	OPTICS & LASERS	
3.	L-T-P structure	3 - 0 - 0	
4.	Credits	3	
5.	Course number	PHL 112	
6.	Status (<i>category for program</i>)	PROGRAM LINKED	

7.	Pre-requisites (<i>course no./title</i>)	PHL 101	
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)		
8.1	Overlap with any UG/PG course of the Dept./Centre	NO	
8.2	Overlap with any UG/PG course of other Dept./Centre	NO	
8.3	Supercedes any existing course	NA	

9.	Not allowed for (<i>indicate program names</i>)	Engineering Physics	
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10.	Frequency of offering	☒ Every sem ☐ 1 st sem ☐ 2 nd sem ☐ Either sem	
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11.	Faculty who will teach the course Prof. K. Thyagarajan, Prof. Arun Kumar, Prof. M.R. Shenoy, Prof Joby Joseph, Prof. Anurag Sharma, Dr. R. K. Varshney, Dr. Amartya Sengupta,		
12.	Will the course require any visiting faculty?	NO	

13.	Course objective (<i>about 50 words</i>): The course gives a review of basic optics, principles of lasers and apply these basics into applications of fiber optics, Fourier optics and holography. Many practical applications of optics and lasers will be covered during problem sessions, that include polarization optics, optical sensors, image processing, visualization, optical metrology etc.		
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Basic optics: Interference and interferometers, phase change on reflection, anti-reflection film; Fresnel and Fraunhofer diffraction and examples, limit of resolution, diffraction grating, resolving power. Polarization optics, examples and applications. Lasers: Laser principles, interaction of radiation and matter, amplification and resonator conditions for laser oscillation, modes of laser, some laser systems and applications. Fiber optics: Light propagation in optical fibers, fiber communication, attenuation and dispersion, single and multi-mode		
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	fibers, fiber amplifiers and lasers, fiber optic sensors. Fourier Optics and Holography: Basics of Fourier transformation, spatial frequency, spatial filtering and some applications; Holographic principles, on-axis and off-axis holograms, types of holograms and some applications.
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15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1	BASIC OPTICS: Interference by division of wavefront and division of amplitude; Phase change on reflection, Non-reflecting films; Michelson interferometer. Fraunhofer diffraction: Single slit, circular aperture; limit of resolution. Diffraction grating, Resolving power. Various states of Polarization, Malus' law, Brewster's law; Double refraction, Wave plates, Faraday effect and Optical Isolator.	9 hr lecture + 2 hr problem solving sessions
2	LASERS: Interaction of radiation and matter, Einstein coefficients, line shape function, condition for amplification; Optical resonators, resonator losses and the quality factor Q. Condition for laser oscillation; Longitudinal- and transverse modes of a laser, Some Laser Systems.	9 hr lecture + 1 hr problem solving sessions
3	FIBER OPTICS: Light propagation in optical fibers, Optical fiber communication, Attenuation and dispersion; Pulse dispersion in multimode fibers; Single-mode fibers, material dispersion; Fiber amplifiers and lasers, Fiber optic sensors.	9 hr lecture + 2 hr problem solving sessions
4	FOURIER OPTICS and HOLOGRAPHY: Basics of Fourier transformation, definition of spatial frequency, FT by diffraction and by lens, Spatial filtering, Phase contrast microscope, some applications; Holographic principles, on-axis and off-axis hologram recording and reconstruction, Types of holograms, some applications.	9 hr lecture + 1 hr problem solving sessions
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12		
COURSE TOTAL (14 times 'L')		42

16. Brief description of tutorial activities

Problem solving sessions to cover topics such as interferometers, polarization optics, optical sensors, laser applications, image processing, imaging techniques, optical metrology etc.

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
1		
2		
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9		
10		
COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. OPTICS, Ajoy Ghatak, Tata McGraw Hill, New Delhi, (5th Edition), 2012.
2. E. Hecht, OPTICS, Pearson Education Inc. (4th Ed.) 2002.
3. A. Ghatak and K. Thyagarajan, OPTICAL ELECTRONICS, Cambridge Univ. Press (1989).
4. J.W. Goodman, INTRODUCTION TO FOURIER OPTICS, Viva Book Pvt. Ltd, New Delhi (3rd Ed.) 2007.

19. Resources required for the course (*itemized & student access requirements, if any*)

19.1	Software	
19.2	Hardware	
19.3	Teaching aides (videos, etc.)	LCD projector
19.4	Laboratory	
19.5	Equipment	
19.6	Classroom infrastructure	
19.7	Site visits	

20. Design content of the course (*Percent of student time with examples, if possible*)

20.1	Design-type problems	10 %
20.2	Open-ended problems	10 %
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	Lab visit

Date: 28 January 2013

(Signature of the Head of the Department)