INDIAN INSTITUTE OF TECHNOLOGY TIRUPATI
PROFORMA FOR NEW COURSE

1.	Title of the Course	Fundamentals of Laser Physics
2.	Course Number	PH6022
3.	Status of the Course	Elective
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 2019
9.	Prerequisite	Nil
10.	Whether approved by the Department	Yes
11.	**Course Objective:** The course introduces aspects of nonlinear and quantum optics leading to a working knowledge of laser physics. It also provides a strong foundation and background necessary for advanced knowledge in quantum optics, laser technology and photonics. The student will learn about advanced laser technology related to semiconductor, solid state, gas phase and ultrafast lasers.	
12.	**Course Content:** Classical optics essentials: Fabry-Perot interferometer, Gaussian beams, resonator theory, cavity modes. Quantum optics essentials: photon statistics, coherence theory. Light matter interaction: resonant interaction - two level model, Rabi oscillation, density matrix, Bloch sphere, non-resonant interaction. Semiclassical theory of light matter interaction: linear and non-linear response, classical anharmonic oscillator model, dispersion, Wigner-Weisskopf theory. Laser theory: 2,3-level schemes, Einstein equations, stimulated emission, spontaneous emission and absorption, Einstein coefficients, population inversion, optical amplification, rate equations, laser oscillation, lasing threshold, gain, hole burning, Lamb dip. Line broadening effects: Doppler and collisional. Laser examples: semiconductor, solid state and gas phase. Ultrashort pulses: generation by Q-switching, mode-locking, characterization by auto-correlation, FROG - frequency resolved optical grating.	
13.	Text book(s): 1. Siegman A E, *Lasers,* University Science Books (1990). 2. Silvfast W T, *Laser Fundamentals,* Cambridge University Press (2009).	
14.	Reference(s): 1. Boyd R W, *Nonlinear Optics,* Academic Press (2009). 2. Fox M W, *Quantum Optics: An Introduction,* Oxford University Press (2009). 3. Milloni P W and Eberly J H, *Lasers,* Wiley-Blackwell (1988). 4. Saleh B E A and Teich M C, *Fundamentals of Photonics,* Wiley-Blackwell (2007).	