

GUJARAT TECHNOLOGICAL UNIVERSITY
NANO TECHNOLOGY
SUBJECT NAME: PHOTONICS
SUBJECT CODE: 2173904
B.E. 7th SEMESTER

Type of course: Optics

Prerequisite: Basic knowledge of electronics, optics, and nanoscience and nanotechnology

Rationale: To make the students understand the role of photonics and its products.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	0	3	70	20	10	0	0	0	100

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	MODERN OPTICS Light, Light-material interaction, Electrodynamics: Maxwell's equations, Electromagnetic wave in different media, Polarization of light, Interference, Absorption, Dispersion and modulation of light Plasmons Quantum optics, Fiber optics and their applications, Lasers and their applications.	11	18%
2	OPTOELECTRONICS Optical processes in semiconductors, Semiconductor optoelectronic Devices, Application of optoelectronic devices, Optoelectronic tweezers.	8	17%

3	PHOTONIC MATERIALS AND DEVICES Photonic crystals, Luminescence, Photorefractive materials Photonic devices: LEDs, Solar cells, photodiodes, photodetectors, photoconductors, Laser diodes, Electro-optic and Magneto-optic devices	10	21%
4	NANOPHOTONICS Nanophotonics and its nature, Device operation: nanophotonic AND gate & OR gate, Adiabatic nanofabrication and Nonadiabatic nanofabrications: near-field optical CVD and near field photolithography, A phototransistor, Charge coupled device.	11	23%
5	NANO BIOPHOTONICS Photobiology, Photosynthesis, Photo excitation, Optical fiber delivery system, Optical Biosensors, Laser activated therapy, laser surgery.	10	21%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
Remembrance R Level	Understanding U Level	Application A Level	Analyze N Level	Evaluate E Level
25	25	30	20	0

Legends: R: Remembrance; U = Understanding; A = Application and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Reference Books:

1. NANOMATERIALS,
New Age International Publishers by A. K. Bandyopadhyay.
2. SOLID STATE PHYSICS,
Wiley publication by Charles Kittel.
3. PHYSICS OF SEMICONDUCTOR DEVICES,
Wiley publication by S. M. Sze and Kwok K. Ng.
4. ELEMENTS OF PHOTONICS, Vol. I,
Wiley & Sons, by Keigo Iizuka

5. RECENT OPTICAL AND PHOTONIC TECHNOLOGIES,
INTECH, by KI Young Kim.

Course Outcome:

After learning the course the students should be able to:

1. To notify the learner about the light and its nature
2. To know about various optoelectronic devices
3. To have knowledge about nanophotonics and biophotonics with their applications

Design based Problems (DP)/Open Ended Problem:

Open Ended /design based project: A group of students (Maximum Three) has to undertake one open-ended problem/design problem. **(Students are free to select any area of science and technology may be based on their branch to define the project)**

Aims:

1. To provide experience in laboratory-based experimentation, data recording and analysis and drawing of conclusions.
2. To develop report writing skills for scientific material
3. To develop the ability to undertake investigations where, as part of the exercise, the goals and methods have to be defined by the investigator.
4. To develop skills in literature searches and reviews.

Evaluation of Open-ended / design based small project:

1. Open ended / design based small project will be evaluated by the external examiner with appropriate marks allotment given by GTU time to time.
2. Faculties should cultivate problem-based project to enhance the basic mental and technical level of students.
3. Evaluation should be done on **the approach of the student on his/her efforts** (not on completion) to study the design module of given task.

List of Open Source Software/learning website:

<http://ocw.mit.edu/courses/materials-science-and-engineering/>

<http://www.nanosworld.com>

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute,

along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.