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MIT WORLD PEACE UNIVERSITY | PUNE
TECHNOLOGY, RESEARCH, SOCIAL INNOVATION & PARTNERSHIPS

COURSE STRUCTURE

Course Code	SCI102B			
Course Category	Basic Science			
Course Title	Physics			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	03 hours	01 hour	02 hours	02+01+01=04
Pre-requisites: Physics in 12th standard (Board or CBSE)				

Course Objectives:

To equip engineering students with the fundamentals of and latest trends in Physics required for Engineering and to inculcate a scientific and analytical aptitude in them

1.Knowledge (i) To understand the properties and applications of light and matter
(ii) To understand the working of some notable Physics based instruments

2.Skills (i) To acquire skills of using light and laser in various applications
(ii) To acquire experimental and analytical skills required for engineering

3.Attitude A positive attitude towards Physics and it's connection with engineering

Course Outcomes:.

After learning Physics, the engineering students shall demonstrate ability to:

1. Relate the use of fundamentals of optics in precision measurements and other relevant engineering applications – (CL-II)
2. Identify the use of lasers and photonic devices in emerging frontiers of engineering. – (CL-III)
3. Summarize applications of quantum mechanics in advanced engineering instrumentation and upcoming technologies. – (CL-II)
4. Relate to developments and new applications of semiconductors -- (CL-II)
5. Outline the properties, synthesis methods and applications of nanoparticles—(CL-II)

Course Contents:

Optics and Photonics:

A brief review of interference due to thin films and its applications (interferometers and their applications :Newton's rings and Michelson's interferometer) , antireflection and anti-transmission coatings), use of interference in measurements and analysis, Diffraction (basics of single slit diffraction and its correlation with diffraction grating and its applications, Polarization

(types of polarization, principles and devices involved in producing and detecting polarized light, applications of polarization in LCD, polarizing sunglasses, photoelasticity etc., Physics behind lasers, design and applications of a number of lasers (He Ne, Semiconductor and CO_2 lasers)

Preparatory Quantum Mechanics:

Wave nature of matter at subatomic level, De Broglie's hypothesis and its applications, Heisenberg's uncertainty principle, wave function, Schrodinger's equations, quantum mechanics of subatomic particles entrapped in rigid and non-rigid potential boxes, tunnel effect and its applications, a brief discussion of applications of quantum mechanics in understanding matter and energy at subatomic level, some quantum-mechanics- based instruments such as electron microscope, X ray diffractometer and electron diffractometer,, tunnel diode, SQUIDs etc, a brief introduction to qubits, quantum superposition and quantum entanglement, Schrodinger's cat

Condensed Matter Physics:

Band theory of solids, Fermi Dirac statistics, discussion of the semiconductors and semiconducting devices (such as diodes, transistors, solar cells etc) on the basis of energy band diagrams and Fermi levels, Hall effect and its applications, Four probe method, Physics involved in nano-particles, their properties, synthesis and applications, a brief review of carbon based nanostructures such as graphene, carbon nanotubes, fullerene and quantum dots.

Laboratory Exercises / Practical:

Outcomes

After performing the Physics experiments, students shall demonstrate ability to

1. Analyze some properties and a few applications of light, mainly measurements and analysis
2. Evaluate the performance of some semiconductors and devices, especially band gap, characteristics of photodiode, LED, solar cells etc.

List of experiments

1. Determination of Radius of Curvature of plano-convex lens by Newton's rings
2. Determination of wavelengths of spectral lines of Mercury (Hg) source by using diffraction grating
3. Law of Malus
4. Laser based experiment (beam divergence)
5. Laser based experiment (measuring width of a narrow slit, diameter of a thin wire, counting number of slits of grating)
6. Determination of energy gap of a semiconductor
7. Characteristics of a Solar cell and determination of its fill factor
8. Study of Photodiode
9. Hall effect
10. Measurement of conductivity using four probe method

Learning Resources:

Reference Books

1. D. Halliday, R. Resnick, J. Walker, Fundamentals of Physics, 9th Edition, (John Wiley and Sons)
2. Avadhanulu M.N., Kshirsagar P.G., "A Textbook of Engineering Physics" 10th edition, (S. Chand)
3. R. P. Feynman, R.B. Leighton, M. Sands, The Feynman Lectures on Physics, Volume I, II and III, revised and extended edition, (Narosa Publihing House)

Supplementary Reading:

1. A. Beiser, Concepts of Modern Physics, 6th Edition, (Tata McGraw Hill)
2. F. Jenkins, H. White, Fundamentals of Optics, 4th Edition, (Tata McGraw Hill)
3. C. Poole, F. Owens, Introduction to Nanotechnology, (John Wiley and Sons)

Web Resources:

Optics and Photonics

1. https://www.photonics.com/
2. SPIE - the international society for optics and photonics: *spie.org/*
3. Optical Society of America (OSA): http://www.osa.org/
4. Optical Society of India: www.osiindia.org/
5. https://www.laserworld.com/
6. www.lasertech.com/
7. Indian laser association (www.ila.org.in/)
8. http://nptel.ac.in/courses/115105083/13

Preparatory Quantum Mechanics

9. https://quantumphysics.iop.org/
10. https://quantumphysicsmadesimple.com/
11. http://nptel.ac.in/courses/115102023/

Semiconductor Physics

12. www.electronics-tutorials.ws
13. www.hyperphysics.com

Nanotechnology

14. "Richard Feynman's prophetic speech in 1959 in front of American Physical Society.
    There is plenty of room at the bottom
    http://www.pa.msu.edu/~yang/RFeynman_plentySpace.pdf

15. www.nanotech-now.com/

16. www.understandingnano.com
17. https://www.nanowerk.com
18. http://nptel.ac.in/courses/118102003/2

MOOCs (Coursera)

1. https://www.coursera.org/courses?languages=en&query=PHYSICS
2. https://www.coursera.org/learn/nanotechnology
3. https://www.coursera.org/learn/philosophy-physical-sciences

MIT Opencourseware

Optics

https://ocw.mit.edu/high-school/physics/exam-prep/physical-optics/interference-diffraction/

Quantum Mechanics

https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/

Pedagogy:

1. Co-teaching
2. Group activity
3. Tutorials
4. Audio- video techniques
5. Assignments and class tests
6. Expert lecture

Assessment Scheme:

Class Continuous Assessment (CCA): 50 marks

Assignments	Test	Presentations (Group activity)	Case study	MCQ	Oral	Any other (Attendance and initiative)
15/50 marks (30%)	15/50 marks (30%)	15/50 marks (30%)	--	--	--	5/50 marks (10%)

Tutorial Continuous Assessment (TCA): **50 marks**

Extensive problem solving in tutorial sessions

Tutorial Exam I	Tutorial Exam II
25 marks (50%)	25 marks (50%)

Laboratory Continuous Assessment (LCA): **50 marks**

Regularity and punctuality	Understanding of objective	Understanding of procedure	Experimental skills	Ethics
10/50 marks (20%)	10/50 marks (20%)	10/50 marks (20%)	10/50 marks (20%)	10/50 marks (20%)

Term End Examination : 50 marks

Syllabus :

Module No.	Contents	Workload in Hrs		
		Theory	*Lab*	*Assess*
1	Optics and Photonics: (Interference, Diffraction, Polarization, Lasers)	11	12	--
2	Preparatory Quantum Mechanics	07	--	--
3	Condensed Matter Physics (Semiconductor Physics, Nanotechnology)	12	08	--

Prepared by	Checked by	Approved by
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