KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY (KIIT)

Deemed to be University U/S 3 of UGC Act, 1956

SCHOOL OF APPLIED SCIENCES (PHYSICS)

AUTUMN SEMESTER 2022-23
COURSE HANDOUT

Date: 22/09/2022

1. **Course code** : PH 10001
2. **Course title** : Physics
3. **L-T-P Structure** : 3-0-0
4. **Course Coordinator** : Dr. Swetapadma Praharaj
5. **Course faculty** : Dr. Swetapadma Praharaj **Section**: A34

6. **Course Objective:**

To enrich the basic knowledge of Physics to support the Engineering and Research programs. Develop mathematical models to understand the behaviour of various physical systems and phenomena. Establish the gate-way to design and develop the aforementioned thing.

7. **Course Outcomes:**

CO1: Learn basic concepts of oscillation, waves, wave function and fields.
CO2: Understand the principles of wave phenomena in light and matter; and fundamentals of quantum mechanics.
CO3: Apply the principles of oscillation, superposition of waves, electromagnetic theory, and quantum mechanics in different fields.
CO4: Analyse different types of particle motion in different media.
CO5: Evaluation of problem-solving skills for the topics learnt.
CO6: Develop critical thinking ability led by the concepts of Physics learnt in the course.

8. **Course Content:**

Oscillation: Damped Harmonic Oscillation (under damped, over damped and critically damped), Energy decay, Relaxation time, Quality factor, Forced Oscillation, Resonance, Coupled Oscillations, Applications

Waves and Interference: Wave equation, Superposition of waves, Interference of light, Types of interference: division of wavefront and division of amplitude.
Interference in thin films: wedge shaped thin film, Newton's rings and its applications, Michelson interferometer, Applications

Diffraction: Diffraction and its applications, Types of diffraction, Fraunhofer diffraction by a single slit, Plane Diffraction grating (condition of maxima, minima), Maximum order of observable spectra, Absent spectra, Dispersive power, Applications

Electromagnetic Theory: Vector calculus: scalar and vector field, Gradient, Divergence and Curl, Line, surface and volume integrals, Gauss divergence and Stoke's theorem

Electromagnetic spectrum, electromagnetic induction, Lenz's law, Maxwell's equations in differential and integral form with necessary derivations. Electromagnetic wave equations, Transverse nature of EM waves

Quantum Mechanics: Dual nature of radiation and matter, de Broglie hypothesis for matter waves, Phase velocity and Group velocity, Heisenberg's uncertainty principle and applications, Wave function and its interpretation, Concepts of operators, Schrodinger's time dependent and time independent equations, Postulates of Quantum mechanics, Particle in one dimensional box and applications, Quantum tunnelling and applications

Laser and Fiber optics: LASER: properties and applications, Spontaneous and stimulated emission, Meta-stable state, Population inversion, Pumping, Three and four-level laser, Ruby Laser
Optical fiber: principle, construction, types of optical fiber, Acceptance angle, Numerical aperture, Applications

9. Text book:

- Engineering Physics, B. K. Pandey and S. Chaturvedi, Cengage Publication, New Delhi, 2nd Edition 2022, ISBN-13: 978-81-953536-7-5.

10. Reference books

- Introduction to Electrodynamics, D J Griffiths, Pearson Education, 4th Edition, 2015.
- Quantum Mechanics, L. I. Schiff, Tata McGraw-Hill Publications, 4th Edition, 2014, ISBN-978125906865
- Optics, A. K. Ghatak, Tata McGraw-Hill Publications, 4th Edition, 2008, ISBN-9780070262157
- Concepts of Modern Physics, A. Beiser, Tata McGraw-Hill Publications, 6th Edition, 2002, ISBN-10:0071234608
- Engineering Physics, R K Gaur and S. L. Gupta, Dhanpat Rai Publications, New Delhi, 2nd Edition, 2012, ISBN-19:8189928228

11. Lesson Plan and Learning Activities

Module	Topic of Discussion	Lecture No.
	Interaction with students	**1**
	Interaction with students	**2**
	Relevance of physics in engineering	**3**
	Course overview	**4**
Oscillations	Introduction: Oscillations and its day to day applications	**5**
	Damped oscillation: equation of motion and solution of a damped oscillator	
	Types of damped oscillations with examples.	**6**
	Log decrement, energy decay, relaxation time and quality factor	
	Forced oscillation: equation of motion, steady state solution and amplitude expression	**7**
	Amplitude resonance: calculation of resonance frequency and maximum amplitude at resonance frequency	**8**
	Coupled oscillation**:** equation of motion and decoupling of equation, normal modes and normal frequencies of oscillation	**9, 10**
	Doubt clearing and numerical problems	**11**
	Assignment-I	

Waves and Interference	Equation for a progressive wave, superposition of waves, interference of light, conditions of interference, types of interference (with examples): division of wavefront and division of amplitude.	**12**
	Interference in thin films: wedge shaped thin film	**13, 14**
	Newton's rings: experimental set up, formation, expression of diameter of bright and dark rings, applications	**15, 16**
	Doubt clearing and numerical Problems	**17**
	Assignment-II	
	Michelson Interferometer : construction, working principle and types of fringes	**18**
	Quiz-I	
	Assignment of Topics for Critical Thinking	
Diffraction	Diffraction and applications, types of diffraction	**19**
	Fraunhofer diffraction due to single slit and expression of resultant intensity	**20**
	Maxima (principal and secondary) and minima, intensity distribution and its significance	**21**
	Diffraction through N-slits (plane transmission grating), resultant intensity, principal maxima, Maximum order of observable spectra, dispersive power	**22**
	Missing (absent) spectra, Doubt clearing and numerical problems	**23**
Electromagnetic Theory	Vector calculus: gradient, divergence, curl, and vector identities; Gauss divergence theorem, Stoke's theorem, numerical problems	**24**
	Empirical laws of electricity and magnetism, Maxwell's EM equations in Integral and differential form, displacement current, equation of continuity	**25-27**
	Electromagnetic wave equations, velocity of electromagnetic wave in vacuum and electromagnetic spectrum	**28**
	Transverse nature of electromagnetic waves	**29**
	Doubt clearing and numerical problems	**30**
	Assignment-III	
Quantum Mechanics	Introduction, dual nature of radiation and matter, de Broglie hypothesis for matter waves, wavelength of photon, relativistic and non-relativistic free particle, and charged particle	**31**
	Phase velocity (v_p) and group velocity (v_g) in relativistic and non-relativistic limits; relation between v_p and v_g	**32**
	Heisenberg's uncertainty principle and its application, numerical problems	**33**
	Submission of Critical Thinking Report	
	Wave function and its significance; characteristics of wavefunction, postulates of quantum mechanics, operators	**34**
	Schrodinger's time-independent and time-dependent equations, Application of Schrodinger's equation: particle confined in 1D potential box, energy eigen value, eigen function	**35-36**
	Quantum mechanical tunneling (qualitative) and its applications	**37**
	Doubt clearing and numerical problems	**38**
	Quiz-II	

Laser and Fiber Optics	Laser: properties and applications, spontaneous and stimulated emissions, population inversion, pumping mechanism (types); 3 and 4 level laser schemes	**39**
	Ruby laser: principle, construction and working	**40**
	Fiber optics: principle, construction, types of optical fibers, applications	**41**
	Acceptance angle and numerical aperture, doubt clearing and numerical problems	**42**

12. Internal Assessment Components:

Sl. No.	Assessment Component	Weightage /Marks	Duration	Nature of the test component
1	Mid Semester Examination	20	90 minutes	Closed Book
2	End Semester Examination	50	3 hours	Closed Book
3	**Learning activities:** (a) Assignment (b) Quiz (c) Critical thinking	 15 10 05		 Open book Closed book Open book

13. Activity Calendar:

Sl. No.	Type of Activity/ Active learning Assessment Component	CO mapping	Weightage /Marks	Schedule for Activities
1	Assignment-I	CO1, CO5	5	Date of Assignment-26/10/2022 Date of Submission-31/10/2022
2	Assignment-II	CO1, CO2, CO3	5	Date of Assignment-09/11/2022 Date of Submission-11/11/2022
3	Quiz-I	CO1, CO2, CO3, CO5	5	12/11/2022
4	Assignment-III	CO3, CO5	5	Date of Assignment-14/12/2022 Date of Submission-19/12/2022
5	Quiz-II	CO1, CO2, CO3, CO4, CO5	5	07/01/2023
6	Critical Thinking	CO6	5	Date of Assigning-14/11/2022 Date of Submission-21/12/2022

14**. Attendance:** Every student is expected to be regular (in attendance) in all lecture classes, tutorials, labs, tests, quizzes, seminars etc and in fulfilling all tasks assigned to him / her. Attendance will be recorded and 75% attendance is compulsory.

15. **Makeup:**

- No make-up examination will be scheduled for the mid semester examination. However, official permission to take a make-up examination will be given under exceptional circumstances such as admission in a hospital due to illness/ injury, calamity in the family at the time of examination.
- A student who misses a mid-semester examination because of extenuating circumstances such as admission in a hospital due to illness / injury, calamity in the family may apply in writing via an application form with supporting document(s) and medical certificate to the Dean of the School for a make-up examination.
- Applications should be made within five working days after the missed examination.

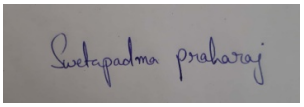
16. **Discussion of Mid Semester performance:**
Performance of the mid -semesterexamination will be discussed in class.

17**. Pre-end semester total marks**: Please see the SAP portal link

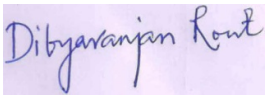
18**. Course Management System: SAP Portal**
Is a software system designed to facilitate teachers in the management (instructional content, assessment and documentation) of the courses for their students, both teachers and students can monitor the system. Though usually considered as a tool and often used to complement the face-to-face classroom.

19**. Chamber consultation hour for doubts clarification:**
Will be teacher specific and will be duly notified by the concerned teacher.

20**. Notices:**
All course related notification would be conveyed by the course faculty either via the respective Google classroom or WhatsApp group or email.



Dr. Swetapadma Praharaj
Course Coordinator



Dr. Dibyaranjan Rout
Coordinator, Physics