



S.V. University 4-Year Honours Degree Programme

Model Syllabus for Physics (Minor) in consonance with Curriculum framework w.e.f. AY 2026-27

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
II	IV	2	Waves and Optics	3	3
			Waves and Optics-Practical	2	1

SEMESTER-IV

COURSE 2: WAVES AND APPLIED OPTICS

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVE:

This course introduces the physical principles of oscillatory motion, interference, and polarization of light, and explores modern optical phenomena including lasers, optical fibers, and holography. The objective is to build a deep conceptual understanding of wave behavior in mechanical and optical systems and their technological applications.

LEARNING OUTCOMES:

On successful completion of this course, the students will be able to:

1. Describe the basic characteristics of waves such as frequency, wavelength, amplitude, period, and speed and utilize mathematical relationships related to wave characteristics.
2. Understand the phenomenon of interference of light and its formation in Thin films and Newton's rings and Distinguish between Fresnel's diffraction and Fraunhofer diffraction and observe the diffraction patterns in the case of single slit.
3. Explain the various methods of production of plane, circularly and polarized light and their detection and the concept of optical activity.
4. Comprehend the basic principle of laser, the working of He-Ne laser and Ruby lasers and their applications in different fields.
5. Understand the basic principles of fibre optic communication and explore the field of Holography and Nonlinear optics and their applications.

UNIT-I: SIMPLE HARMONIC, DAMPED & FORCED OSCILLATIONS (9hrs)

Simple Harmonic Oscillator: Solution of differential equation, and physical characteristics, Principle of superposition, Combination of two mutually perpendicular SHMs (1:1 and 1:2 frequencies), Lissajous figures. Damping, Damped Harmonic Oscillator: Solution of differential equation, Energy considerations, Logarithmic decrement, relaxation time, quality factor, Forced Oscillations: Solution of differential equation.

UNIT-II: INTERFERENCE AND DIFFRACTION (9 hrs)

Interference: Principle of superposition – coherence Conditions for interference of light. Fresnel's biprism determination of wavelength of light, change of phase on reflection, Oblique

incidence of a plane wave on a thin film due to reflected light (cosine law) –Newton's rings in reflected light. Determination of wavelength of monochromatic light using Newton's rings.

Diffraction: Introduction, distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction – Diffraction due to single slit, Difference between interference and diffraction.

UNIT-III: POLARIZATION

(9 hrs)

Polarized light: methods of polarization by reflection, refraction, double refraction, Brewster's law, Malus law, Nicol prism polarizer and analyser, Quarter wave plate, Half wave plate, optical activity - Determination of specific rotation by Laurent's half shade Polarimeter. Idea of elliptical and circular polarization

UNIT-IV: LASERS

(9 hrs)

Lasers: Introduction, Spontaneous emission, Stimulated emission, Population Inversion, Laser principle, Einstein coefficients, Types of lasers: He-Ne laser, Ruby laser, Semiconductor laser, Applications of laser.

UNIT-V: OPTICAL FIBERS AND HOLOGRAPHY

(9 hrs)

Principle of Optical fibers, Acceptance angle, Acceptance cone, Numerical aperture, Types of optical fibers - Graded and Stepped index, Types Signal attenuation mechanisms in optical fibers, Applications of Optical fibers - Sensors, Imaging, Communication.

Holography: Basic principle of holography-Gabor hologram and its limitations, Applications of holography.

REFERENCE BOOKS:

1. BSc Physics Vol.1, Telugu Academy, Hyderabad.
2. Fundamentals of Physics. Halliday/Resnick/Walker, Wiley India Edition 2007.
3. Waves & Oscillations. S. Badami, V. Balasubramanian and K.R. Reddy, Orient Longman
4. BSc Physics, Vol .2, Telugu Academy, Hyderabad
5. A Text Book of Optics-N Subramanyam, L Brijlal, S. Chand & Co.
6. Unified Physics Vol. II Optics & Thermodynamics – Jai Prakash Nath & Co. Ltd., Meerut
7. Optics, F.A. Jenkins and H.G. White, Mc Graw-Hill 5. Optics, Ajay Ghatak, Tata Mc Graw-Hill. Introduction of Lasers – Avadhanulu, S. Chand & Co.
8. Principles of Optics- BK Mathur, Gopala Printing Press, 1995

SEMESTER-IV

COURSE 2: WAVES AND APPLIED OPTICS

Practical

Credits: 1

2 hrs/week

COURSE OBJECTIVE:

This course provides students with a broad understanding of the physical principles of the oscillations, to help them develop critical thinking and aims to provide students with a fundamental understanding of the behavior and properties of light and its interaction with matter.

LEARNING OUTCOMES:

1. Perform experiments to analyze oscillatory systems and visualize resonance and damping.
2. Use optical instruments to study interference and polarization.
3. Measure the wavelength of light using Newton's rings and biprism methods.
4. Understand laser characteristics and fiber optic transmission through practical demonstration.
5. Record, analyze, and interpret experimental data with precision.

Minimum of 6 experiments to be done and recorded

1. Determination of 'g' by compound/bar pendulum
2. Simple pendulum normal distribution of errors-estimation of time period and the error of the mean by statistical analysis Verification of inverse square law of light using photovoltaic cell.
3. Determination of radius of curvature of a given convex lens-Newton's rings.
4. Resolving power of grating.
5. Study of optical rotation – polarimeter.
6. Dispersive power of a prism.
7. Determination of wavelength of light using diffraction grating-minimum deviation method.
8. Determination of wavelength of light using diffraction grating-normal incidence method.
9. Determination of thickness of a thin wire by wedge method
10. Refractive index of liquid using laser and rectangular container
11. Optical fiber - Numerical Aperture.

STUDENT ACTIVITIES

UNIT-I: Simple harmonic, damped & forced oscillations

Activity: Measuring the period of a simple pendulum and verifying the relationship between the period and the length of the pendulum. Students can use a stopwatch and a ruler to measure the time for a fixed number of oscillations and calculate the period.

Activity: Measuring the damping coefficient of a mass-spring system and calculating the quality factor. Students can measure the amplitude of the system as it undergoes damped oscillations and use the logarithmic decrement formula to calculate the damping coefficient. They can then use the formula for the quality factor to evaluate the quality of the system.

UNIT-II: Interference and Diffraction

Ask students to measure the diameter of the central bright spot and the diameter of the n th ring for different values of n , and then calculate the wavelength of light.

Build a simple diffraction grating using a piece of cardboard and some sewing needles. Ask students to measure the distance between the needles, count the number of lines per unit length, and then calculate the grating spacing and the wavelength of light.

UNIT-III: Polarization

Ask students to measure the angle of rotation of the polarized light before and after passing through the sample, and then calculate the specific rotation of the sample.

Unit-IV: Lasers

Activity: Laser Communication Demo – Group project to transmit voice using a laser beam and photodiode.

Unit-V: Optical fibers and Holography

Demonstrate the principle of holography using a laser beam, a beam splitter, and a photographic plate. Ask students to record a hologram of a simple object and then reconstruct the image using a laser beam.

Prepared by:

Dr. G. Suresh Babu
Member, BOS
Lecturer in Physics
GDC, Puttur
Tirupati Dist. A.P.

Dr. C. Bapanayya
Member, BOS
Lecturer in Physics
SVA GDC(M) Srikalahasti
Tirupati Dist. A.P

Dr. A. Sujala Swapna Smitha
Member, BOS
Lecturer in Physics
GDC, Puttur
Tirupati Dist. A.P

Dr. C. Sai Vandana
Member, BOS
Lecturer in Physics
GDC(W) Srikalahasti
Tirupati Dist. A.P

Dr. E. Rekha
Member, BOS
Lecturer in Physics
SWR GDC(W) Kalikiri
Annamayya Dist. A.P



Dr. M. Surya Sekhar Reddy
Chairperson, BOS
Lecturer in Physics
GDC(W) Madanapalle
Annamayya Dist. A.P.

4- Year UG Honours MINOR

Syllabus

(2026-27)

Semester- IV

Model Question Paper

Time : 3hrs

Marks:75

Part-A

Answer any Five Questions. Each Question carries 3 Marks.

5x3=15

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

Answer the following questions. Each question carries 12 Marks

5x12=60

11. a) Unit-I
(Or)
b) Unit-I

12. a) Unit-II
(Or)
b) Unit-II

13. a) Unit-III
(Or)
b) Unit-III

14. a) Unit-IV
(Or)
b) Unit-IV

15. a) Unit-V
(Or)
b) Unit-V