Assignment Booklet

**M.Sc. (Physics) Programme
(MSCPH)**

OPTICS

Valid from 1ˢᵗ July, 2024 to 30ᵗʰ June, 2025

ignou
THE PEOPLE'S
UNIVERSITY

**School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068
(2024-25)**

Dear Student,

Please read the section on assignments in the Programme Guide for M.Sc. (Physics). A weightage of 30 per cent, as you are aware, has been earmarked for continuous evaluation, **which would consist of one tutor-marked assignment** for this course. The assignment is in this booklet. The total marks for this assignment is 50, of which 20 marks are needed to pass it.

Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully:

1) On top of the first page of your answer sheet, please write the details exactly in the following format:

ENROLMENT NO.: …..………………………………………

NAME: …………………………………………………

ADDRESS: ………………………………………………

COURSE CODE:………………………….

COURSE TITLE: …………………………

ASSIGNMENT CODE: …………………..

STUDY CENTRE: ………………………..   **DATE:** …………….……………………………

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.

2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.

3) Leave 4 cm margin on the left, top and bottom of your answer sheet.

4) Your answers should be precise.

5) **Submit the complete assignment answer sheet within the due date.**

6) The assignment answer sheets are to be submitted to your Study Centre as per the schedule. **Answer sheets received after the due date shall not be accepted. We strongly suggest that you retain a copy of your answer sheets.**

7) This assignment is **valid from 1st July, 2024 to 30th June, 2025**. If you have failed in this assignment or fail to submit it by June 30th, 2025, then you need to get the assignment for the year 2025-26, and submit it as per the instructions given in the Programme Guide.

8) **You cannot fill the examination form for this course** until you have submitted this assignment. For any queries, please contact: srjha@ignou.ac.in, drsgupta@ignou.ac.in

We wish you good luck.

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Tutor Marked Assignment
OPTICS

Note: Attempt all questions. The marks for each question are indicated against it.

1. Write Maxwell's equations for electric and magnetic fields in a charge free dielectric medium. Using these equations, obtain the wave equations for the electric and magnetic fields in the dielectric medium. Will the speed of electromagnetic waves in the dielectric medium be same as that in the free space? Justify your answer. (2+6+2)

2. Write the expressions for two orthogonal plane polarised light waves propagating in z-direction and have equal amplitudes and phase difference of $(\pi/2)$. Obtain the expression for the electric field of the resultant wave arising due to the superposition of these two waves. Determine the trajectory of the tip of the electric field vector associated with the resultant wave. (5)

3. Show that corresponding to any direction of propagation of electromagnetic wave in an anisotropic medium, there are two orthogonal plane (linearly) polarised plane waves which propagate, in general, with two different velocities. (5)

4. Determine the normalised Jones vector for a left-circularly polarised (LCP) light propagating in z-direction. (5)

5. Given that refractive index of oil is 1.38, what should be the minimum thickness of oil film if the light of wavelength $6000 \overset{\circ}{A}$ is found to be absent in the reflected light. (5)

6. Using the scalar diffraction theory, derive Fresnel-Huygens diffraction integral

$$U(P) = \frac{iE_0}{\lambda} \iint_A \left(\frac{e^{ikr}}{r} \right) d\xi d\eta$$

which gives the field at point P on the observation plane due to diffraction of light from an aperture A. (10)

7. What do you understand by optical waveguide? Derive the set of equations relating various components of electric and magnetic fields in a waveguide for TE and TM modes of propagation. (3+7)

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