BPHCT-137

ASSIGNMENT BOOKLET

BACHELOR'S DEGREE PROGRAMME
(B.SC.G)

WAVES AND OPTICS

Valid from 1st January, 2023 to 31st December, 2023

School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068
(2023)

Dear Student,

Please read the section on assignments in the Programme Guide for B. Sc. that we sent you after your enrolment. 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, and it consists of two parts, Part A and B. The total marks of all the parts are 100, of which 35% 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:

ROLL NO.: ……………………………………………

NAME: …………………………………………………

ADDRESS: ……………………………………………

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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) Solve Part A and Part B of this assignment, and **submit the complete assignment answer sheets containing Parts A and B 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 January, 2023 to 31st December, 2023**. If you have failed in this assignment or fail to submit it by 31st December, 2023, then you need to get the assignment for the year 2024, 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.

Tutor Marked Assignment
WAVES AND OPTICS

Course Code: BPHCT-137
Assignment Code: BPHCT-137/TMA/2023
Max. Marks: 100

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

PART A

1. a) The resultant wave due to superposition of two waves of the same frequency, velocity and amplitude travelling in opposite directions on a string fixed at both ends is given as

$$y(x,t) = 2\sin\frac{\pi x}{6}\cos 20\,\pi t \text{ cm}$$

Determine the equations representing the superposing waves and calculate the distance between two consecutive antinodes. (6+4)

b) In a fluid medium, the speed of sound waves is 280 ms^{-1} and its frequency is 450 Hz. Calculate the phase difference between two displacements of a particle of the medium at a point at time 10^{-3} s apart. (5)

c) Show that when two in-phase linearly polarised light waves are superposed, the resultant wave has fixed orientation as well as amplitude**.** Depict the orientation of electric field vector of the resultant wave in the reference plane. (6+4)

2. a) Discuss the principle of Michelson interferometer. How is it used to determine the refractive index of a thin plate? (5+5)

b) Describe the experimental set up for observing Newton's rings. Show that the radius of a dark Newton's ring is directly proportional to the square root of the radius of curvature of the lens used. (4+6)

c) The inclined faces of a glass biprism (μ = 1.5) make an angle of 1° with its base. The biprism is illuminated by a sodium lamp (λ = 589 nm) and the eye piece is at a distance of 1 m from the slit. A convex lens inserted between the biprism and the eye piece gives clear images of coherent sources in the focal plane of the eye piece. If the images are 0.4 cm apart in one case and 0.16 cm apart in the second case, calculate the width of interference fringes observed on the screen. (5)

PART B

3. a) A vertical single and double slits are illuminated by a point source. Discuss the salient features of their Fraunhofer diffraction patterns. Also, obtain an expression for intensity distribution in case of double slit. (5+5+10)

b) Calculate the maximum number of principal maxima that can be formed with a grating having 4500 lines per cm for light of wavelength 490 nm. (5)

4. a) Discuss applications of lasers in medicine and communication. (5)

b) Define numerical aperture and angle of acceptance. An optical fiber has a numerical aperture of 0.20 and cladding refractive index of 1.59. Calculate the refractive index of the core material and the acceptance angle of the fibre in water whose refractive index is 1.33. (5+5)

c) With the help of a labelled diagram, discuss lasing action of a He-Ne laser. (5)

d) List and explain various types of losses in an optical fibre. (5)

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