PHE-09

ASSIGNMENT BOOKLET
Bachelor's Degree Programme (B.Sc.)

OPTICS

Valid from January 1, 2023 to December 31, 2023

It is compulsory to submit the Assignment before filling up the Term-End Examination Form.

Please Note

- **You can take electives (56 to 64 credits) from a minimum of TWO and a maximum of FOUR science disciplines, viz. Physics, Chemistry, Life Sciences and Mathematics.**
- **You can opt for elective courses worth a MINIMUM OF 8 CREDITS and a MAXIMUM OF 48 CREDITS from any of these four disciplines.**
- **At least 25% of the total credits that you register for in the elective courses from Life Sciences, Chemistry and Physics disciplines must be from the laboratory courses. For example, if you opt for a total of 64 credits of electives in these 3 disciplines, at least 16 credits should be from lab courses.**
- **You cannot appear in the Term-End Examination of any course without registering for that course. Otherwise, your result will not be declared and the onus will be squarely on you.**

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

2023

Dear Student,

We hope you are familiar with the system of evaluation to be followed for the Bachelor's Degree Programme. At this stage you may probably like to re-read the section on assignments in the Programme Guide for Elective Courses that we sent you after your enrolment. A weightage of 30 per cent, as you are aware, has been earmarked for continuous evaluation which consists of **one tutor-marked assignment** for this 4-credit course. **Submit your assignments at your study centre.**

Instructions for Formatting Your Assignments

Before attempting the assignment, please read the following instructions carefully:

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

ENROLMENT NO.:……

NAME :……

ADDRESS :……

……

……

COURSE CODE: …….

COURSE TITLE : …….

ASSIGNMENT NO. ……..…

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 and in your own words. Do not copy answers from study material.
5) While solving problems, clearly indicate the question number along with the part being solved. Write units at each step of your calculations as done in the text because marks will be deducted for such mistakes. Take care of significant digits in your work. Recheck your work before submitting it.
6) **This assignment will remain valid from January 1, 2023 to December 31, 2023**. However, you are advised to submit it within **12 weeks** of receiving this booklet to accomplish its purpose as a teaching-tool.

Answer sheets received after the due date shall not be accepted.

We strongly feel that you should retain a copy of your assignment response to avoid any unforeseen situation and append, if possible, a photocopy of this booklet with your response.

We wish you good luck.

Tutor Marked Assignment
OPTICS

Course Code: PHE-09
Assignment Code: PHE-09/TMA/2023
Max. Marks: 100

Note: Attempt all questions. Symbols have their usual meanings. The marks for each question are indicated against it.

---

1. Answer any **four** parts: (5×4=20)

   a) Write down Maxwell's field equations for free space and obtain expressions for velocity of electromagnetic waves.

   b) Discuss the significance of accommodation and convergence of human eye in respect of perception of light.

   c) Discuss, with necessary theory, how is interference pattern in Young's double slit experiment modified when a thin glass plate is introduced in the path of one of the interference waves?

   d) 'Diffraction limits the image forming capability of optical devices'. Discuss the authenticity of this statement for the particular case of a microscope.

   e) Discuss the importance of hologram in (i) information storage, and (ii) pattern recognition.

2. a) A plane e.m. wave is incident normally on an interface. Obtain expressions for reflection and transmission coefficients. (10)

   b) Show that superposition of two linearly polarised light waves having different amplitudes and a finite phase difference can be used to produce elliptically plane polarised waves. (5)

   c) How is image formed on the retina of human eye processed by human brain? Discuss. (5)

3. a) Discuss the principle of Michelson interferometer. How is it used to determine the refractive index of a thin plate? (10)

   b) 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. (5)

   c) The inclined faces of a glass biprism ($\mu = 1.5$) make an angle of 1° with its base. The biprism is illuminated by a sodium lamp ($\lambda = 589$ 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)

4. 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)

5. 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)

******