Universiti Tun Hussein Onn Malaysia

# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## SEMESTER II
## SESSION 2023/2024

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| COURSE NAME | : | OPTICS AND WAVE |
| COURSE CODE | : | BWC 21703 |
| PROGRAMME CODE | : | BWC |
| EXAMINATION DATE | : | JULY 2024 |
| DURATION | : | 3 HOURS |
| INSTRUCTIONS | : | 1. ANSWER ALL QUESTIONS<br>2. THIS FINAL EXAMINATION IS CONDUCTED VIA<br>☐ Open book<br>☒ Closed book<br>3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK |

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

**Q1** (a) List **FIVE (5)** phenomena associated with visible light, along with a brief explanation of each.

(10 marks)

(b) A zoom lens camera is positioned 90.0 cm away from a flower with a diameter of 1.2 cm. The lens has a focal length of 150.0 mm.

(i) Find the distance between the lens and the film.

(3 marks)

(ii) How large is the image of the flower?

(3 marks)

(iii) Illustrate a ray diagram using the three principal rays that confirms the algebraic solution.

(4 marks)

**Q2** (a) Outline and explain the quantity and its corresponding units used to describe light.

(14 marks)

(b) (i) Calculate the luminous intensity of a light-emitting diode (LED) that emits approximately 1100 lumens while radiating light equally in all directions, given that it operates at 20 watts.

(3 marks)

(ii) Determine the total luminous flux of a light source emitting one candela uniformly in all directions. Given that a complete sphere encompasses a solid angle of $4\pi$ steradians.

(3 marks)

**Q3** (a) A laser with wavelength, $\lambda = 690.0$ nm is used to illuminate two parallel slits. On a screen that is 3.30 m away from the slits, interference fringes are observed. The distance between adjacent bright fringes in the centre of the pattern is 1.80 cm.

(i) Sketch a diagram depicting the scenario described above. Label all relevant parameters accordingly.

(4 marks)

(ii) Calculate the distance between the slits.

(6 marks)

(b) The diffraction pattern resulting from a single slit, which has a width of 0.020 mm, is observed on a screen positioned at a distance of 1.20 m from the slit. The light source used has a wavelength of 430 nm.

(i) Create a diagram illustrating the described scenario. Label all pertinent parameters appropriately.

(4 marks)

(ii) Calculate the width of the central maximum.

(6 marks)

**Q4** (a) List and provide explanations for the **THREE (3)** forms of light polarization.

(9 marks)

(b) Light with intensity $I_0$ is incident on an ideal polarizing sheet. The transmitted intensity is $\frac{1}{2}I_0$. How can you determine whether the incident light is randomly polarized or linearly polarized? If it is linearly polarized, what is the direction of its polarization?

(5 marks)

(c) Explain the applications of lasers in industry, medicine, and research.

(6 marks)

**- END OF QUESTIONS -**

**APPENDIX A**

**Table APPENDIX A.1**

| | | | |
|---|---|---|---|
| $\frac{1}{p}+\frac{1}{q}=\frac{1}{f}$ | $M=\frac{h_i}{h_o}=\frac{d_i}{d_o}$ | $P=\frac{1}{f}$ | $tan\theta=\frac{y}{D}$ |
| $dsin\theta=m\lambda$ | $dsin\theta=\left(m+\frac{1}{2}\right)\lambda$ | $a\ sin\theta=m\lambda$ | |