Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	OPTIC
COURSE CODE	:	DAU 10303
PROGRAMME CODE	:	DAU
EXAMINATION DATE	:	JULY/ AUGUST 2023
DURATION	:	2 HOURS AND 30 MINUTE
INSTRUCTION	:	1. ANSWERS TO **ALL** QUESTIONS.
		2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**.
		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 **SIX (6)** PAGES

Q1 (a) (i) State **four (4)** characteristics of light wave.

(4 marks)

(ii) State the difference between longitudinal waves and transverse waves.

(2 marks)

(iii) From your answers above, give **one (1)** example for each type of wave.

(2 marks)

(b) (i) Describe total internal reflection of light.

(2 marks)

(ii) Define critical angle.

(2 marks)

(iii) Describe **two (2)** conditions for total internal reflection to occur.

(2 marks)

(iv) Give **three (3)** examples of phenomena of total internal reflection in our daily life.

(3 marks)

(v) Compute the minimum index of refraction for a plastic prism to be used in binoculars so that the incoming light with an angle of incidence on 45° will be totally internally reflected in the prism. Given the refractive index of air is 1.00.

(4 marks)

(c)

Radio waves	X	Infrared	Visible light	Ultraviolet	X-rays	Gamma rays

(i) The diagram above shows the electromagnetic spectrum in order. Name the electromagnetic wave in region X.

(2 marks)

(ii) The frequency for the wave in region X is 2.50×10^{9} Hz. Calculate the wavelength of the wave in region X.

(2 marks)

Q2 (a) (i) State the law of reflection of a plane mirror.

(2 marks)

(ii) Identify the characteristics of the image formed by a plane mirror.

(4 marks)

(b) A convex spherical mirror with a radius of curvature of 20 cm produces an erect image half of the size of the real object. Determine:

(i) the focal length of the mirror.

(4 marks)

(ii) the image position.

(4 marks)

(iii) the object position.

(3 marks)

(c) An object located 35.70 cm from a lens forms an image 7.80 cm in front of the lens. The image is located on the same side as the object.

(i) Calculate the focal length of the lens.
(3 marks)

(ii) Identify the types of lenses. State the reason.
(2 marks)

(iii) Identify the image real or virtual. From your answer, explain the reason.
(3 marks)

Q3 (a) State **three (3)** differences between interferences and diffraction
(3 marks)

(b) Name **two (2)** types of diffraction and state the differences between both types of diffraction.
(6 marks)

(c) A single slit of width of 0.16 mm is illuminated by a monochromatic light and a diffraction pattern is observed on a screen 1.50 m from the slit.

(i) If the third dark fringe is 24 mm from the central bright band, calculate the wavelength of the light.
(4 marks)

(ii) Compute the distance of the fifth dark fringe from the central bright band.
(4 marks)

(d) Red light of wavelength of 650 nm is incident normally on a grating and the second order bright band is diffracted at an angular deviation of 3.80° from the central bright band.

(i) Calculate how many lines per meter are marked on the grating.
(4 marks)

(ii) Compute the distance of the third order bright band from the central bright band if the distance between the grating and screen is 2 m.
(4 marks)

Q4 (a) State **two (2)** differences between constructive interferences and destructive interferences.
(4 marks)

(b) **Figure Q4(b)(ii)** shows a schematic diagram of Michelson Interferometer. Describe the principle of the Michelson Interferometer.
(6 marks)

(c) In a Young double slit experiment, it was found that the fringe separation in 1.80 mm. The distance between the slits and the screen is 1.50 m and the wavelength of light used is 450 nm. Calculate:

(i) the slit separation.
(4 marks)

(ii) the distance between the fringes if the slit separation is decreased by half of its original distance.
(4 marks)

(d) In a diffraction grating experiment, the second order maximum is formed at an angle of 35° from the central maximum. If the light used has a wavelength of 750 nm, calculate the number of lines per centimeter in the grating.

(7 marks)

-END OF QUESTIONS –

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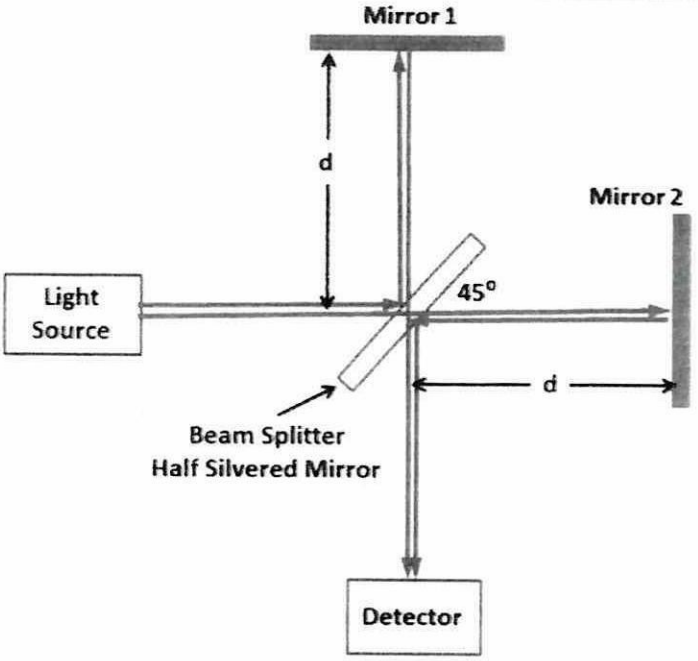

Figure 4 (b)(ii)

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LIST OF FORMULAE

$\tan\theta_b = \frac{n_2}{n_1}$	$M = \frac{h_i}{h_o}$	$y_m = \frac{m\lambda L}{d}$
$I = I_o cos^2\theta$	$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$	$E = \frac{hc}{\lambda}$
$\sin\theta_c = \frac{n_2}{n_1}$	$D = \frac{1}{f}$	$\partial_m = dsin\theta_m = m\lambda$
$n_1 sin\theta_1 = n_2 sin\theta_2$	$\lambda = \frac{2\pi}{k}$	$n = \frac{\lambda_{air}}{\lambda_{material}}$
N= 1/ d		