Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	OPTIC
COURSE CODE	:	DAU 10303
PROGRAMME CODE	:	DAU
EXAMINATION DATE	:	JULY 2024
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTION	:	1. ANSWER ALL QUESTIONS. 2. THIS FINAL EXAMINATION IS CONDUCTED VIA ☐ Open book ☒ 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 **FIVE (5)** PAGES.

Q1 (a) Two polarizing sheets are placed together with their axes of polarization making an angle of 35°. Unpolarized light passes through them.

(i) Sketch and label the phenomena for this situation.

(5 marks)

(ii) Determine the percentage of the light intensity transmitted through both polarizers.

(4 marks)

(iii) State two (2) advantages of wearing a pair of Polaroid sunglasses during an afternoon stroll when the sun is bright hot.

(2 marks)

(b) An electromagnetic wave propagates in a material with a speed of 2.10×10^8 ms^{-1} and a frequency of 1.20×10^{10} Hz.

(i) Determine the wavelength in air.

(3 marks)

(ii) Calculate the refractive index of the material.

(3 marks)

(c) A transverse wave is given by

$$y = 6.0 \sin \pi (4.0\, t + 0.020\, x)$$

where x and y are in centimeters and t in seconds. Determine the speed of the wave.

(3 marks)

Q2 (a) A concave mirror has radius of curvature 40.0 cm. A nail of 5.00 cm long is placed upright on the principal axis, 45.0 cm in front of the mirror.

(i) Sketch and label the ray diagram of the image.

(3 marks)

(ii) Calculate the distance of the image.

(3 marks)

(iii) Determine the size of the image.

(2 marks)

(iv) State the three (3) characteristics of the image.

(1.5 marks)

(b) A 10.0 cm tall object is placed 15.0 cm in front of convex mirror with a radius of curvature 40.0 cm.

(i) Sketch and label the ray diagram of the image.

(3 marks)

(ii) Calculate the position of the image.

(3 marks)

(iii) Determine the height of the image.

(3 marks)

(iv) State the three (3) characteristics of the image.

(1.5 marks)

Q3 (a) Describe the difference manner between the camera and eye lens.

(4 marks)

(b) By using your own words, explain briefly how and where is the image form in your eye.

(6 marks)

(c) A student constructs an astronomical telescope with a magnification of 10. If the telescope has a converging lens of focal length 50 cm, calculate:

(i) the focal length of the eyepiece,

(3 marks)

(ii) the resulting length of the telescope.

(3 marks)

(d) Explain the difference between nearsightedness and farsightedness.

(4 marks)

Q4 (a) Differentiate between constructive interferences and destructive interferences.

(4 Marks)

(b) Describe the principle of the Michelson Interferometer.

(6 marks)

(c) Two narrow slits are 0.05 mm apart. A monochromatic light of wavelength 450 nm is used to illuminate the slits. A fringe pattern is formed on a screen 4 m away.

(i) Define monochromatic light and name the phenomenon that occurred.

(2 marks)

(ii) Calculate the distance between adjacent bright fringes.

(2 marks)

(iii) Calculate the distance between the third bright fringes form on a screen.

(2 marks)

(iv) If one of the slits is covered, sketch a graph of the intensity of light of the fringe pattern versus its position, θ.

(3 marks)

(v) Name the phenomenon that occurred in **Q4(c)(iv).**

(1 mark)

Q5 (a) (i) Define the term diffraction.

(2 marks)

(ii) Name two (2) types of diffraction.

(2 marks)

(iii) State two (2) differences between both types of diffraction.

(4 marks)

(b) A single slit of a 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. Calculate:

(i) the wavelength of the light if the third dark fringe is 24 mm from the central bright band.

(4 marks)

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

(4 marks)

(c) The slit separation of a diffraction grating is 2×10^{-6} m. The grating is illuminated normally by a monochromatic light with a wavelength of 750 nm. Calculate the maximum number of bright fringes that can be observed.

(4 marks)

-END OF QUESTIONS –

APPENDIX A

LIST OF FORMULAS

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