POLITEKNIK
MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENGAJIAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI I 2025/2026

DEO30013 : OPTICAL FINDAMENTALS

TARIKH : 22 NOVEMBER 2025
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **TUJUH (7)** halaman bercetak.

Bahagian A : Subjektif (4 soalan)
Bahagian B : Esei (1 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 80 MARKS
BAHAGIAN A : 80 MARKAH

INSTRUCTION:
This section consists of **FOUR (4)** subjective questions. Answer **ALL** questions.

ARAHAN:
Bahagian ini mengandungi EMPAT(4) soalan subjektif. Jawab SEMUA soalan.

QUESTION 1
SOALAN 1

CLO1   (a)   List **FOUR (4)** optoelectronic devices.

Senaraikan EMPAT (4) peranti optoelektronik.

[4 marks]

[*4 markah*

CLO1   (b)   With the aid of a diagram, explain the characteristics of light wave.

Dengan bantuan gambarajah, terangkan ciri-ciri gelombang cahaya.

[6 marks]

[6 *markah*]

CLO1   (c)   In an experiment of photoelectric, a 450 nm blue light is directed on a sodium surface with a work function of 2.46 eV. Given mass of electron is 9.11 x 10^{-31} kg, calculate the maximum velocity of electron, V_{max}.

Dalam eksperimen fotoelektrik, sebuah 450 nm cahaya biru ditujukan pada permukaan sodium dengan fungsi kerja 2.46 eV. Diberi jisim elektron adalah 9.11× 10^{-31} kg, kirakan kelajuan maksimum elektron, V_{max}

[10 marks]

[10 *markah*]

QUESTION 2
SOALAN 2

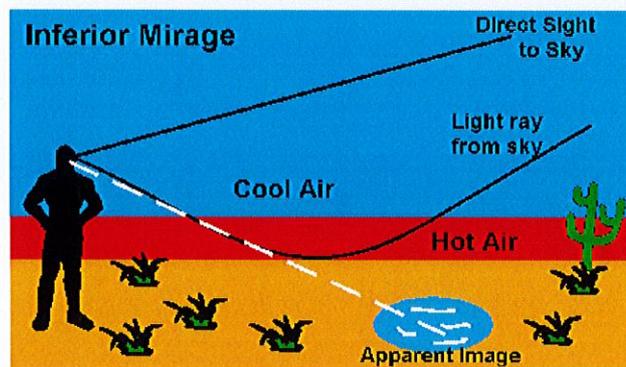CLO1   (a)   Describe a photon with an illustration.

Perihalkan tentang foton beserta dengan ilustrasi.

[4 marks]
[*4 markah*]

CLO1   (b)   Figure A2(b) shows the phenomenon of a mirage. Explain that phenomenon.

Rajah A2(b) menunjukkan fenomena fatamorgana. Terangkan fenomena tersebut.

Figure A2 (b) / *Rajah A2(b)*

[8 marks]
[*8 markah*]

CLO1   (c)   An object is placed in front of the convex lens as shown in Figure A2(c). Express the characteristics of image that obtained by that lens using rays drawing method.

Sebuah objek diletakkan di hadapan kanta cekung seperti dalam Rajah A2(c). Nyatakan ciri-ciri imej yang diperolehi oleh kanta tersebut dengan menggunakan kaedah lukisan sinaran.
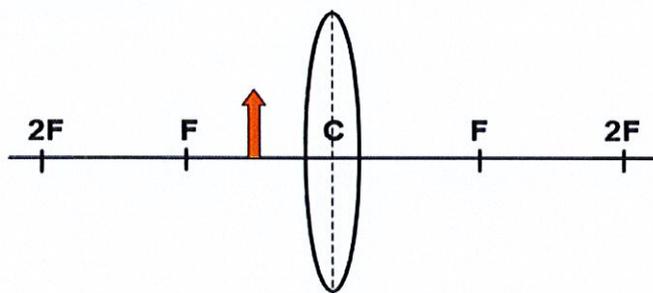

Figure A2 (c) / *Rajah A2(c)*

[8 marks]
[*8 markah*]

QUESTION 3
SOALAN 3

CLO1   (a)   With the aid of a diagram, describe chromatic aberration.

Dengan bantuan gambarajah, perihalkan tentang kecacatan kromatik.

[4 marks]

[*4 markah*]

CLO1   (b)   Discuss Hyperopia defect as shown in Figure A3(b).

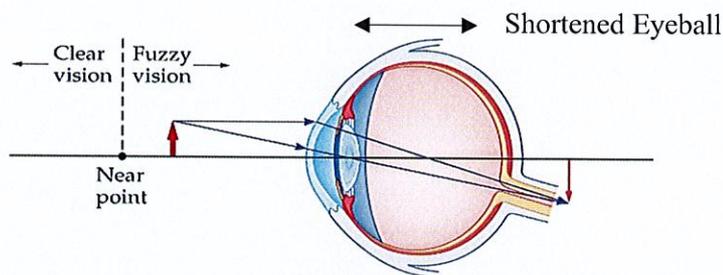*Bincangkan kecacatan Hyperopia seperti yang ditunjukkan dalam Rajah A3(b).*

Figure A3(b) / *Rajah A3(b)*

[6 marks]

[*6 markah*]

CLO1   (c)   An object with 8 cm tall is placed at 125 cm from a convex lens with focal length of 50 cm. Calculate the height of image with the characteristics of image by using sign convention table.

Sebuah objek dengan ketinggian 8 cm ditempatkan pada 125 cm dari kanta cembung yang mempunyai panjang fokus 50 cm. Kirakan ketinggian imej serta ciri-ciri imej dengan menggunakan jadual kelaziman tanda.

[10 marks]

[*10 markah*]

QUESTION 4
SOALAN 4

CLO1   (a)   With the aid of a diagram, describe circular polarization.

Dengan bantuan gambarajah, perihalkan tentang polarasi bulatan.

[4 marks]

[4 *markah*]

CLO1   (b)   With the aid of a diagram, explain the constructive and destructive interference.

Dengan bantuan gambarajah, terangkan tentang gangguan membina dan gangguan memusnah.

[6 marks]

[6 *markah*]

CLO1   (c)   In a Young's Double Slit experiment, the separation between the third and sixth bright fringe is 5.8 cm The separation between two slits is 0.24 mm and the distance from the slits to the screen is 3.5 m as shown in figure A4(c). Calculate the wavelenght of light and path length of 6th dark fringe.

Di dalam eksperimen Young's Double Slit, jarak pisahan antara jalur cerah ketiga dan keenam adalah 5.8 cm. Jarak pisahan antara dua bukaan adalah 0.24 mm dan jarak dari bukaan ke skrin adalah 3.5 m seperti yang ditunjukkan di dalam Rajah A4(c). Kirakan panjang gelombang cahaya dan panjang laluan bagi jalur gelap ke-6.
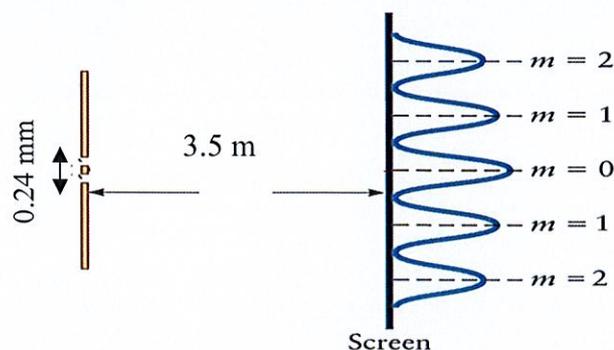

Figure A4(c) / *Rajah A4(c)*

[10 marks]

[10 *markah*]

SECTION B : 20 MARKS
BAHAGIAN B : 20 MARKAH

INSTRUCTION:
This section consists of **ONE (1)** essay question. Answer the question.

ARAHAN :
*Bahagian ini mengandungi **SATU (1)** soalan esei. Jawab soalan tersebut.*

QUESTION 1
SOALAN 1

CLO1

A 380 THz light travels from air (n = 1.00) into core inside the fiber optic cable as shown in Figure B1(i). Given the refractive index of core and cladding are 1.55 and 1.45 respectively. Calculate the incident angle at air-core interface and wavelength of light inside core . Then, write **THREE (3)** conditions that must be obeyed to allow light rays propagate inside the fiber optic cable as shown in Figure B1(ii).

*Suatu cahaya 380 THz bergerak dari udara (n =1.00) ke dalam teras seperti yang ditunjukkan dalam Rajah B1(i). Diberi indeks pembiasan teras dan pelapis adalah 1.55 dan 1.45 masing-masing. Kira sudut tuju pada sempadan udara-teras dan panjang gelombang dalam teras. Kemudian, tuliskan **TIGA (3)** syarat yang mesti dipatuhi bagi membenarkan sinar-sinar cahaya merambat di dalam kabel gentian optik seperti yang ditunjukkan dalam Rajah B1(ii).*
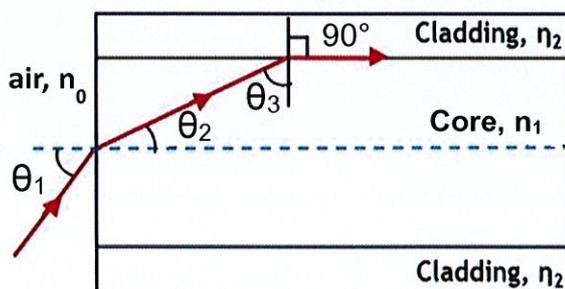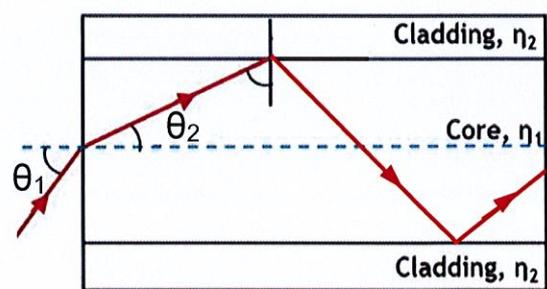

Figure B1(i) / *Rajah B1(i)*   Figure B1(ii) / *Rajah B1(ii)*

[20 marks]

[*20 markah*]

SOALAN TAMAT

$e = 1.602 \times 10^{-19}$ C

$h = 6.625 \times 10^{-34}$ Js

$\sigma = 5.67 \times 10^{-8}$ Wm^{-2}K^{-4}

$°C = 5/9(°F - 32)$

$K = °C + 273.15$

$E = hf = \dfrac{hc}{\lambda}$

$\lambda = \dfrac{c}{f} = \dfrac{v}{f}$

$p = \dfrac{E}{c} = \dfrac{h}{\lambda}$

$A = 4\pi r^2$

$W_B = \varepsilon\sigma AT^4$

$n = \dfrac{c}{v}$

$\theta_c = \sin^{-1}\left(\dfrac{n_2}{n_1}\right)$

$W_o = hf_o$

$E = W_o + K_{max}$

$K_{max} = eV_s = \dfrac{mv_{max}^2}{2}$

$M = \dfrac{hi}{ho} = -\dfrac{v}{u}$

$f = \dfrac{r}{2}$

$\dfrac{1}{f} = \dfrac{1}{u} + \dfrac{1}{v} \qquad P = \dfrac{1}{f}$

$x = \dfrac{\lambda D}{d} = \dfrac{\lambda D}{a}$

$y_{m-1/2} = \left(m - \dfrac{1}{2}\right)x \qquad y_m = mx$

$\delta_m = d\sin\theta_m = d\dfrac{y_m}{D} = m\lambda$

$\delta_{m-1/2} = d\sin\theta_{m-1/2} = d\dfrac{y_{m-1/2}}{D} = \left(m - \dfrac{1}{2}\right)\lambda$

$w = 2x$

$\sin\theta_m = \dfrac{m\lambda}{a}$

$n_1\sin\theta_1 = n_2\sin\theta_2$

Sign Convention Table for Curved Mirror

Quantity	Positive sign (+)	Negative sign (-)
Object distance (u)	Object is Real (in front of mirror)	Object is Virtual (behind mirror)
Image distance (v)	Image is Real (in front of mirror)	Image is Virtual (behind mirror)
Focal length (f) and Radius (r)	Concave Mirror	Convex Mirror
Magnification (M)	Image is upright	Image is Inverted
Image height (hi)	Image is upright	Image is Inverted

Sign Convention Table for Lenses

Quantity	Positive sign (+)	Negative sign (-)
Object distance (u)	Object is Real (in front of lens)	Object is Virtual (behind lens)
Image distance (v)	Image is Real (behind lens)	Image is Virtual (in front of lens)
Focal length (f)	Convex Lens	Concave Lens
Lens Power (P)	Convex Lens	Concave Lens
Magnification (M)	Image is upright	Image is Inverted
Image height (hi)	Image is upright	Image is Inverted