

SULIT



**KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI**

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

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI I : 2024/2025

DEO30013: OPTICAL FUNDAMENTALS

TARIKH : 11 DISEMBER 2024

MASA : 08.30 PAGI – 10.30 PAGI (2 JAM)

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

Bahagian A: Subjektif (4 soalan)

Bahagian B: Esei (1 soalan)

Dokumen sokongan yang disertakan : Kertas Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

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)** characteristics of light.
Senaraikan EMPAT (4) ciri-ciri cahaya. [4 marks]
[4 markah]
- CLO1 (b) With the aid of diagram, explain the Atom Equilibrium Theory.
Dengan bantuan gambarajah, terangkan Teori Keseimbangan Atom. [6 marks]
[6 markah]
- CLO1 (c) A blackbody radiator with emissivity of 0.9 radiates 450 THz photons at temperature of 1728.65 °C on a surface area of 250,000 mm². Calculate the radiated power, energy of photon in eV and the momentum of photon that has been radiated by that blackbody radiator.
Sebuah pemancar jasad hitam dengan kebolehpancaran 0.9 memancarkan 450 THz foton pada suhu 1728.65 °C ke atas suatu permukaan dengan keluasan 250,000 mm². Kirakan kuasa pancaran, tenaga foton dalam eV dan momentum foton yang telah dipancar oleh pemancar jasad hitam. [10 marks]
[10 markah]

QUESTION 2**SOALAN 2**

- CLO1 (a) Describe light as an electromagnetic wave with an illustration.

Perihalkan cahaya sebagai gelombang elektromagnet beserta dengan ilustrasi.

[4 marks]

[4 markah]

- CLO1 (b) Explain the process of light dispersion in prism as shown in Figure A2(b).

Terangkan proses penyebaran cahaya di dalam prisma seperti yang ditunjukkan dalam Rajah A2(b).

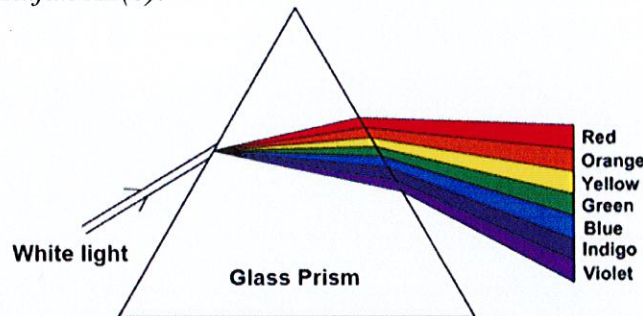


Figure A2 (b) / Rajah A2(b)

[8 marks]

[8 markah]

- CLO1 (c) An object is placed 100 cm in front of the convex lens as shown in Figure A2(c). Express the characteristics of image that obtained by that lens by using rays drawing method.

Sebuah objek diletakkan 100 cm di hadapan kanta cembung seperti dalam Rajah A2(c). Nyatakan ciri-ciri imej yang diperolehi oleh kanta tersebut dengan menggunakan kaedah lukisan sinaran.

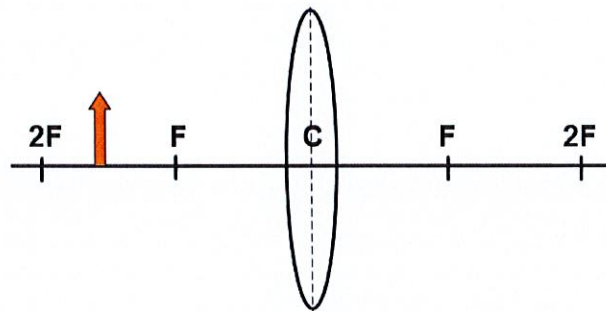


Figure A2 (c) / Rajah A2(c)

[8 marks]

[8 markah]

QUESTION 3**SOALAN 3**

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

Dengan bantuan gambarajah, perihalkan tentang kecacatan sfera.

[4 marks]

[4 markah]

- CLO1 (b) Discuss compound microscope as shown in Figure A3(b).

Bincangkan mikroskop kompaun seperti yang ditunjukkan dalam Rajah A3(b).

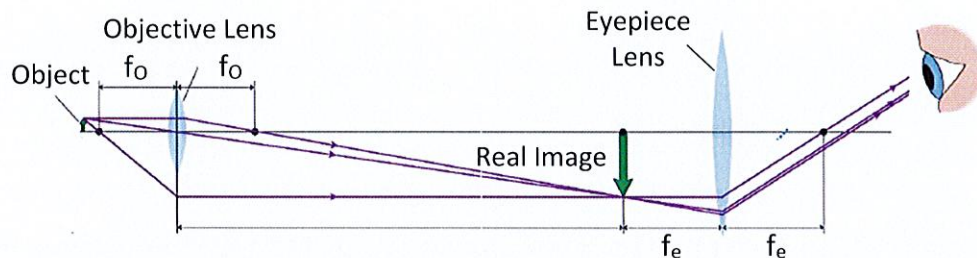


Figure A3(b) / Rajah A3(b)

[6 marks]

[6 markah]

- CLO1 (c) A spectacle has a concave lens with -5 D power. If a 20 cm tall object is placed 80 cm in front of lens, calculate the height of image that has been produced by lens.

Sebuah cermin mata mempunyai kanta cekung dengan kuasa -5 D. Jika sebuah objek dengan ketinggian 20 cm diletakkan 80 cm dari kanta, kirakan ketinggian imej yang terhasil daripada kanta tersebut.

[10 marks]

[10 markah]

QUESTION 4
SOALAN 4

- CLO1 (a) Describe diffraction with an illustration

Perihalkan tentang pembelauan beserta ilustrasi.

[4 marks]

[4 markah]

- CLO1 (b) Compare Fraunhofer and Fresnel Diffraction with the aid of a diagram.

Bandingkan Pembelauan Fraunhofer dan Fresnel dengan bantuan gambarajah.

[6 marks]

[6 markah]

- CLO1 (c) A 588 nm coherent laser light was entering a single slit of 0.25 mm width as shown in Figure A4(c). A diffraction pattern is then formed on a screen with 2 m apart from the slit. Calculate, the width of central bright fringe, location of fourth order dark fringe and diffraction angle of 4th dark fringe.

Suatu 588 nm cahaya laser koheren telah memasuki bukaan tunggal yang mempunyai kelebaran 0.25 mm seperti yang ditunjukkan dalam Rajah A4(c). Sebuah corak pembelauan kemudiannya terbentuk di atas skrin dengan 2 m dari bukaan. Kirakan kelebaran jalur cerah tengah, lokasi jalur gelap ke-4 dan sudut pembelauan untuk jalur gelap ke-4.

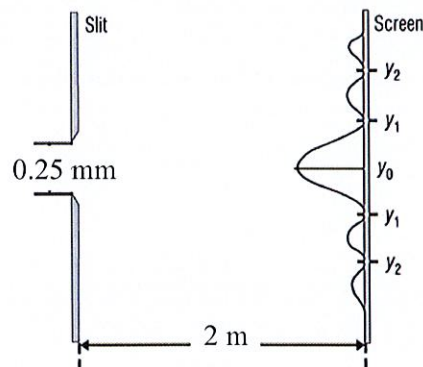


Figure A4(c) /Rajah A4(c)

[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 layer of oil and glass that floats on the water surface is shown in Figure B1(i). A ray of light with frequency of 5.09×10^{14} Hz travels from oil to glass layer with an incidence angle of 40° . Based on Figure B1(i), calculate the refraction angle, speed and wavelength of light in the water. If the direction of the refraction ray in water is changed as shown in Figure B1(ii), calculate the incidence angle, θ_1 in the oil.

Satu lapisan minyak dan kaca yang terapung di atas permukaan air ditunjukkan di dalam Rajah B1(i). Satu sinaran cahaya berfrekuensi 5.09×10^{14} Hz bergerak dari minyak ke lapisan kaca pada sudut tuju 40° . Berdasarkan Rajah B1(i), kirakan sudut pembiasan, kelajuan dan panjang gelombang cahaya di dalam air. Jika arah sinaran pembiasan di dalam air diubah seperti dalam Rajah B1(ii), kirakan sudut tuju, θ_1 di dalam minyak.

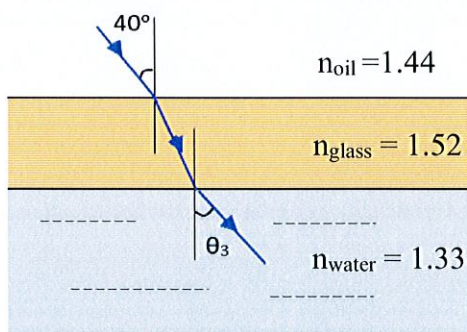


Figure B1(i) / Rajah B1(i)

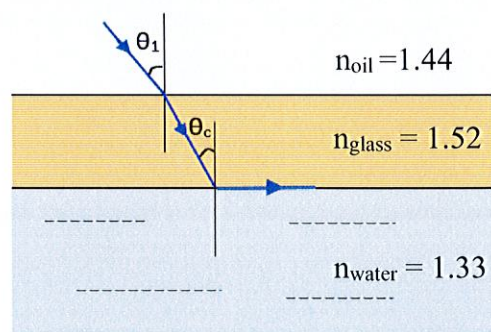


Figure B1(ii) / Rajah B1(ii)

[20 marks]

[20 markah]

SOALAN TAMAT

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

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

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

$$^{\circ}\text{C} = 5/9(^{\circ}\text{F} - 32)$$

$$\text{K} = ^{\circ}\text{C} + 273.15$$

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

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

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

$$A = 4\pi r^2$$

$$W_B = \varepsilon \sigma A T^4$$

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

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

$$W_o = hf_o$$

$$E = W_o + K_{max}$$

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

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

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

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v} \quad P = \frac{1}{f}$$

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

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

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

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

$$w = 2x$$

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

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

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