Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Mark Schemes

Q1.

(a) Spreading of pulse / parts of a pulse take different times to travel through the fibre / pulse broadening✔

Do not credit material dispersion.

owtte

Due to different paths through the optical fibre / due to entering the optical fibre at different angles ✔

Accept a diagram showing different paths.

2

(b) $\text{speed } (= \frac{distance}{time}) = \frac{10 \times 10^3}{5.225 \times 10^{-5}}$ ✓ $(= 1.91 \times 10^8)$

1

(c) Reads off Sin θ_R = 0.3391

or

use of $n_1 \sin\theta_1 = n_2 \sin\theta_2$✔

Use of $n = \frac{c}{c_s}$ seen✔

With their Sin θ_R

(Refractive index of core = 1.47)

Allow use of their refractive index where cs is the subject of the formula

$cs = 2.03 \times 10^8$ ✔

Alternative:

Reads off Sin θ_R = 0.3391

or

$\theta = 19.8°$ ✔

$c_s \cos 19.8 = 1.9 \times 10^8$ ✔

$c_s = 2.03 \times 10^8$ ✔

Allow finding θ_R for their read off

Downloaded from www.merit-minds.com

Allow use of their θ_R

3

(d) The refractive index of core for blue light is greater than the refractive index for red / The refractive index of core for red light is less than the refractive index for blue ✔

Max 1 mark for stating that the refractive indices are different because their speeds are different

MP1 can come from graph or prior knowledge

The speed of the blue light is less than the speed of the red light and travel the same distance / The speed of the red light is greater than the speed of the blue light and travel the same distance✔

2

(e) the blue now travels a shorter distance than the red light (compared to (d))✔

or

the red light now travels a greater distance than the blue light (compared to (d))✔

or

the difference between the blue's velocity parallel to the central axis and the red's velocity (parallel to the central axis) has decreased (compared to (d)).✔

Allow: now travel different distances whereas previously travelled the same distance.

or

the difference between the horizontal velocity of the red light and the horizontal velocity of the blue light has decreased (compared to (d)).✔

1

[9]

Q2.

(a) smooth line drawn within half grid square of points ✔

minimum between 32.6 and 32.8 cm ✔

2

(b) value of their minimum (cm) ✔

Within a half grid square

1

(c) doubles 0.2 **OR** calculates percentage uncertainty for 0.2 (half range) ✔

Correct answer earns both marks

0.8 (%) ✔

CAO

2

(d) recognises that node-to-node spacing = $\lambda/2$ ✔

recognises the need to divide by 8 ✔

Downloaded from www.merit-minds.com

2.36 $\times 10^9$ (Hz) ✔

Condone use of 7 or 9

3 sf required

For example:

$\lambda = \frac{0.509 \times 2}{8}$ *or 0.127(25) m seen; top line earns* $_1$✔ *and bottom line earns* $_2$✔

$f\left(=\frac{3\times10^8\times8}{0.509\times2}\right)$ *= 2.36 ×10^9 (Hz) earns all 3 marks*

$f\left(=\frac{3\times10^8\times7}{0.509\times2}\right)$ *= 2.06 ×10^9 earns 2 marks*

$f\left(=\frac{3\times10^8\times9}{0.509\times2}\right)$ *= 2.65 ×10^9 earns 2 marks*

Allow 2 marks for 4.72 × 10^9 (must be 3 sf)

3

(e) (microwaves are) <u>polarised</u> ✔

1

[9]

Downloaded from www.merit-minds.com