Assignment 10

The due date for submitting this assignment has passed. Due on 2018-10-10, 23:59 IST.

As per our records you have not submitted this assignment.

1) 0 points

The nonlinear phase change in a Kerr medium of cross section 100 μm² length 10 km due to an incident light of wavelength 1 μm and power 1 W.

(\text{the \ Kerr coefficient } n_2 = 3 \times 10^{20} \text{m}^2/\text{W} ;)

(a) 12\pi  
(b) 6\pi  
(c) 2\pi  
(d) 8\pi

No, the answer is incorrect.
Score: 0

Accepted Answers:
(b)

2) 2 points

The nonlinear frequency shift due to self-phase modulation for an optical pulse has a Gaussian temporal profile given by \( I(\tau) = I_0 e^{\frac{-2t^2}{t_0^2}} \).

(a) \( \frac{4n_2 I_0}{t_0^2} e^{\frac{-2t^2}{t_0^2}} \)  
(b) \( \frac{4n_2 I_0 k_0 \tau}{t_0^2} \)  
(c) \( \frac{4n_2 I_0 k_0 \tau}{t_0^2} e^{\frac{-2t^2}{t_0^2}} \)  
(d) \( \frac{2n_2 I_0}{t_0^2} \)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c)

3) 2 points

Follow the above question (Q.2), the maximum wavelength shift per meter with (where \( T_0 = 100 \text{fs} \), \( I_0 = 1 \text{GW/cm}^2 \), \( n_2 = 10^{-16} \text{cm}^2/\text{W} \) and the central wavelength \( \lambda_0 = 1.55 \mu\text{m} \)).

(a) (b) (c) (d)
The nonlinear polarization for Centrosymmetric molecule is $P_{\text{NL}} = S_0 \chi^{(3)} E^3$. Consider the electric field as $E = E_0 \cos(\omega t)$. The number of frequencies in the output will be

(a) 1  (b) 3  (c) 4  (d) 2

No, the answer is incorrect.
Score: 0
Accepted Answers: (d)

4)

The change in refractive index ($\Delta n$) due to cross phase modulation when a 1W power falls on a medium of cross-sectional area $1\text{mm}^2$ ($n_2 = 10^{-18}\text{m}^2/\text{W}$)

(a) $6 \times 10^{-14}$  (b) $16 \times 10^{-12}$  (c) $12 \times 10^{-12}$  (d) $3 \times 10^{-13}$

No, the answer is incorrect.
Score: 0
Accepted Answers: (c)

5)

For centrosymmetric material (invariant under inversion) which of the following is correct (Hint: consider the transformation operation corresponding to a $45^\circ$ rotation about the z-axis)

(a) $\chi^{(3)}_{xxxx} = \chi^{(3)}_{xxyy} + \chi^{(3)}_{xyyx}$

(b) $\chi^{(3)}_{xxxx} = \chi^{(3)}_{xxyy} + \chi^{(3)}_{xyyx}$

(c) $\chi^{(3)}_{xxxx} = \chi^{(3)}_{xxyy} + \chi^{(3)}_{xyyx}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
7) 2 points

If \( \chi^{(3)} \) is complex, then the nonlinear absorption coefficient \( \beta \) in terms of imag part of \( \chi^{(3)} \) is

(a) \( \frac{3\omega}{2c_0n^2c^2} \text{Im}[\chi^{(3)}] \)

(b) \( \frac{3\omega}{4c_0n^2c^2} \text{Im}[\chi^{(3)}] \)

(c) \( \frac{3\omega}{c_0n^2c^2} \text{Im}[\chi^{(3)}] \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)
(b)
(c)

8) 2 points

Following from Q7 the value of \( \beta \) for silicon at 1550 nm is \( (n = 3.5; \text{Im}[\chi] \approx 3 \times 10^{-20} \text{m}^2/\text{V}^2) \)

(a) \( 4.6 \times 10^{-12} \text{ m/W} \)

(b) \( 6.6 \times 10^{-13} \text{ m/W} \)

(c) \( 5.6 \times 10^{-12} \text{ m/W} \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)
(b)
(c)

9) 2 points

Following from Q 8 if a light of intensity \( I_0 = 5 \text{ GW/cm}^2 \) incidents on a medium of length 1 m what will be the intensity at the output

(a) \( 1.78 \times 10^{11} \text{ W/m}^2 \)

(b) \( 2.82 \times 10^{10} \text{ W/m}^2 \)

(c) \( 1.78 \times 10^{12} \text{ W/m}^2 \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)
(b)
(c)

10) 2 points

The self-focussing phenomenon is governed by

(a) \( n_2^2 \)

(b) \( \beta_{TFA} \)

(c) \( n_0 \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)