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NPTEL

Courses » Introduction to Non-linear Optics and its Applications

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Unit 8 - Week 6

Course outline

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Pre-requisite Assignment

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Week 2

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Week 6

● Lecture 26 : SHG in KDP crystal, Calculation of deff

● Lecture 27: SHG in LiNbO3

● Lecture 28 : Quasi phase matching (QPM)

● Lecture 29 : Quasi phase matching (QPM) (cont), Periodic d function

● Lecture 30 : 1st, 2nd, 3rd order QPM, SHG under depleted pump

○ Quiz : Week 6 Assignment 6

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Week 6 Assignment 6

The due date for submitting this assignment has passed.   **Due on 2018-09-12, 23:59 IST.**
As per our records you have not submitted this assignment.

1)   *2 points*

For type-1 second harmonic generation and for an incident beam of $100\,M$ cm^2 at $\lambda = 1.06\,\mu m$. Calculate the second harmonic conversion efficiency perfectly phase matched $2.5\,cm$ long KDP crystal. (For KDP crystal 1.5, $d_{eff} = 0.28 \times 10^{-12} m/V$).

(a) 1.7% (b) 7% (c) 17% (d) 34%

○ (a)
○ (b)
○ (c)
○ (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c)

2)   *2 points*

Consider a crystal where *Second Harmonic Generation* (SHG) is achieved with fundamental wave at $\lambda = 1.55\,\mu m$ for an incident beam of $100\,MW/cm^2$. refractive indices of the crystal at $\lambda = 1.55\,\mu m$ and $\lambda = 0.775\,\mu m$ are given $n = 1.56891$ and $n = 1.59892$ respectively. The $I_{SHG}/I_{fundamental}$ for $2.5\,cm$ crystal is approximately. (For the crystal $d_{eff} = 0.28 \times 10^{-12} m/V$).

(a) 10^{-3} (b) 10^{-6} (c) 10^{-9} (d) 10^{-12}

○ (a)
○ (b)
○ (c)
○ (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c)

Google

Consider a crystal where 2nd order *Quasi Phase Matching* (QPM) is achieved
Second Harmonic Generation (SHG) with the fundamental wave at $\lambda = 1.55\,\mu m$.
refractive indices of the crystal at $\lambda = 1.55\,\mu m$ and $\lambda = 0.775\,\mu m$ are given
$n = 1.56891$ and $n = 1.59892$ respectively. The period of nonlinearity (Λ) is

(a) $52\mu m$ (b) $26\mu m$ (c) $78\mu m$ (d) $100\mu m$

○ (a)
○ (b)
○ (c)
○ (d)

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

4)   *2 points*

Consider a crystal where 1st order *Quasi Phase Matching* (QPM) is achieved
Second Harmonic Generation (SHG) with the fundamental wave at $\lambda = 1.06\,\mu m$.
refractive indices of the crystal at $\lambda = 1.06\,\mu m$ and $\lambda = 0.53\,\mu m$ are given as, n
and $n = 1.52$ respectively. The period of nonlinearity (Λ) is

(a) $53\mu m$ (b) $26.5\,\mu m$ (c) $13.25\mu m$ (d) $75\mu m$

○ (a)
○ (b)
○ (c)
○ (d)

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

5)   *2 points*

The third order QPM periodicity for a second harmonic $(e \rightarrow e + e)$ process in lith
tantalite with $\hat{k}$ along the x-axis is (the fundamental wavelength is 1.064μ
$(n(\omega) = 2.145\ ;\ n(2\omega) = 2.215)$

(a) $11.4\mu m$ (b) $7.6\,\mu m$ (c) $22.8\mu m$ (d) $34.2\mu m$

○ (a)
○ (b)
○ (c)
○ (d)

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

6)   *2 points*

The first order QPM periodicity for a sum frequency $(\omega_2 + \omega_3 \rightarrow \omega_s)$ gener
process $(e + e \rightarrow e)$ process in lithium niobate with $\hat{k}$ along the x-axis is . $(n(\omega$
$2.233\ ;\ n(\omega_3) = 2.211; n(\omega_s) = 2.287)$. Given $\lambda_2 = 1.064\mu m, \lambda_3 = 1.550\,\mu m$.
(a) $10\mu m$ (b) $20\,\mu m$ (c) $5\mu m$ (d) $15\,\mu m$

  (a)
  (b)
  (c)
  (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(a)

7)   *2 points*

d_{eff} for a first order QPM interaction is maximized for a structure that has a cycle

(a) 25%   (b) 30%   (c) 50%   (d) 70%

  (a)
  (b)
  (c)
  (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c)

8)   *2 points*

d_{eff} for a third order QPM interaction is maximized for the value of D

(a) 1/3   (b) 1/4   (c) 1/5   (d)1/6

  (a)
  (b)
  (c)
  (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(d)

9)   *2 points*

Under 180° rotation about x-axis the first order susceptibility $\chi_{ii}^{(1)}$ transforms

(a)$\chi_{ii}'^{(1)} = -\chi_{ii}^{(1)}$ (b) $\chi_{ii}'^{(1)} = \chi_{ii}^{(1)}$ (c) $\chi_{ii}'^{(1)} = 0$ (d) none of these

  (a)
  (b)
  (c)
  (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(b)

10)   *2 points*

In Centro symmetric medium which order of susceptibility is non-zero.

(a) $\chi^{(2)}$ (b) $\chi^{(5)}$ (c) $\chi^{(8)}$ (d) $\chi^{(10)}$

  (a)
  (b)

○ (c)

○ (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(b)

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