Unit 13 - Week 12

Week 12 Assignment 12

The due date for submitting this assignment has passed. **Due on 2018-10-24, 23:59 IST.**
As per our records you have not submitted this assignment.

1) *1 point*

Questions 1 - 4 are based on the following paragraph.

An acoustic wave travelling in a medium modifies the optical properties of the medium in terms the relative permittivity and hence the impermeability tensor. It may also modify the polarisatic properties of the incident light wave.

Consider longitudinal acoustic wave travelling along z-direction in an **isotropic** medium. In this

(A) the **impermeability change** tensor of the medium contains two nonzero off-diagonal eleme only

(B) the **permittivity change** tensor of the medium contains three nonzero diagonal elements on

(C) an incident light propagating along x and polarized along the y-direction results diffracted w that will be y-polarized

(D) an incident light propagating along x and polarized along the x-direction results diffracted w that will be y-polarized

- [ ] (A)
- [ ] (B)
- [ ] (C)
- [ ] (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(B)
(C)

2) *1 point*

Consider a y-polarised acoustic shear wave travelling along z-direction in an **isotropic** medium. case

(A) the **impermeability change** tensor of the medium contains **two** nonzero off-diagonal eleme only

(B) the **permittivity change** tensor of the medium contains **two** nonzero diagonal elements onl

(C) an incident light propagating along x and polarized along the z-direction results diffracted w that will be y-polarized

(D) an incident light propagating along x and polarized along the y-direction results diffracted v that will be z- polarized

- [ ] (A)
- [ ] (B)
- [ ] (C)

(C)
(D)

3) 1 point

For a shear acoustic wave which is y-polarised travelling along x direction in an **isotropic** mediu
(A) the diagonal elements of **impermeability** do not change due to this transverse acoustic wav
(B) the off-diagonal elements of **impermeability** do not change due to this transverse acoustic v
(C) due to this shear acoustic wave the **index ellipsoid** of the medium does not undergo any rot
(D) the RI along z *i.e.,* n_z is modulated by this transverse acoustic wave in the medium

- (A)
- (B)
- (C)
- (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A)

4) 1 point

Consider an anisotropic medium **($LiNbO_3$)** in which an x- polarised acoustic shear wave travellin along y- direction.
(A) In this case there are only **two** nonzero off-diagonal elements that correspond to x, y cross components in the resulting **strain** tensor
(B) In general for acoustic shear wave, the **strain** tensor assumes **two** nonzero off-diagonal elen only that correspond to the directions of propagation and direction of polarisation of the acous wave
(C) In this case effectively the **permittivity change** tensor of the medium contains only **four** non off-diagonal elements that correspond to x, y and x, z cross components
(D) an incident light propagating along y and polarized along the z-direction results diffracted w will remain y- polarized

- (A)
- (B)
- (C)
- (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A)
(B)
(C)

5) **Questions 5 - 10 are based on the acousto-optic modulators.** 1 point

Which of the following is/are required for an acoustic Bragg transducer having a large value of f of merit?
(A) High refractive index
(B) High density
(C) High acoustic velocity
(D) Low photo-elastic constant

- (A)
- (B)
- (C)
- (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A)

6) The number of **resolvable spot** in an acoustic-optic transducer is/are *1 point*

(A) proportional to the wavelength of the acoustic-wave
(B) linearly proportional to the central frequency of the transducer
(C) linearly proportional to the length
(D) linearly proportional to the velocity of the acoustic wave

- (A)
- (B)
- (C)
- (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A)

7) *1 point*

For an acoustic transducer with $\boldsymbol{H = 2\ mm, L = 5\ cm, f = 40\ MHz}$, in dense flint glass of $\boldsymbol{n\ 1.92, \bar{p} = 0.25, v_a = 3.1 \times 10^3 m/s}$ and $\boldsymbol{\rho = 6.3 \times 10^3\ kg/m^3}$, the calculated value of the angle is

(A) $0.12°$
(B) $0.25°$
(C) $0.41°$
(D) $0.84°$

- (A)
- (B)
- (C)
- (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A)

8) *1 point*

Suppose, the frequency of a piezo-electric crystal **6 MHz**, velocity of the acoustic wave in water **m/s** and the wavelength of the input light is **632.8 nm**. What is the angle between **0th** and **1st** or **Raman-Nath** diffracted beam?

(A) $0.09°$
(B) $0.11°$
(C) $0.54°$
(D) $1.21°$

- (A)
- (B)
- (C)
- (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(B)

9) *1 point*

About **Raman-Nath** acousto-optic diffraction of light waves, which of the following is/are correc

(A) The direction of the **+1 order** diffracted wave is given by the relation $\sin\theta_{+1} = \frac{\lambda_0}{n_0\Lambda}$

(B) The transmitted electric fields in various diffraction orders are proportional to the respectiv orders of Bessel's functions

(C) If the incident acoustic wave is ***amplitude*** modulated, 1st order diffracted beam will be ***inte*** modulated

(D) only **+1/-1** order diffracted waves have the same frequency as that of the incident wave

- [ ] (A)
- [ ] (B)
- [ ] (C)
- [ ] (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A)
(B)
(C)

10) *1 point*

Which of the following is/are the requirement/s of **Bragg** acousto-optic modulators?

(A) The angle of the input optical beam should be twice the **Bragg angle** *i.e.*, $2\theta_B$

(B) The **+1 or -1** order of diffracted beam is taken as the output beam of the modulator

(C) The interaction length between optical and the acoustic beams is long, *i.e.*, $L \gg \frac{\Lambda^2}{\lambda}$

(D) The modulation depth is given as $\eta_B = \frac{I_0 - I}{I_0}$, where I_0 and I refer to incident and diffractec intensity

- ( ) (A)
- ( ) (B)
- ( ) (C)
- ( ) (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(C)

11) *1 point*

Questions 11 - 12 are based on the magneto-optic effect.

The magneto-optic effect can be broadly classified on the basis of transmission, reflection, and absorption of the light wave by/through magnetic materials. Which of the following statement/ is/are correct?

(A) In the **transmission mode**, a linearly polarised light travels through a magnetised sample, th plane of polarisation undergoes a rotation

(B) In the **transmission mode**, if the direction of magnetisation is parallel to the optical path, s configuration is known as **Faraday effect**

(C) **Kerr effect** in magneto-optics corresponds to **reflection mode:** the polarisation of reflected from the surface of a magnetized material undergoes a change

(D) **Absorption mode** of magneto-optic effect corresponds to the difference in the absorption coefficient of LCP and RCP components of the light

- [ ] (A)
- [ ] (B)
- [ ] (C)
- [ ] (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:

(A)
(B)
(C)
(D)

12) ***1 point***

In case of **magneto-optic Faraday effect**, a plane polarised light passes through a magnetised sa
acting as an optical medium. The direction of light path and that of magnetisation are the same
(A) a linearly polarised light when passes through a magnetised sample the emerging light is sti
linearly polarised
(B) a linearly polarised light when passes through a magnetised sample, the emerging light is
elliptically polarised
(C) the outcome of Faraday effect is independent of the length of light path interacting with th
magnetised optical medium
(D) the outcome of Faraday effect is directly proportional to the strength of magnetisation of th
optical medium with which the light interacts

- [ ] (A)
- [ ] (B)
- [ ] (C)
- [ ] (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A)
(D)

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