Total No. of Page(s): 03 *Roll No.....*

FIRST SEMESTER **B.E.(ALL)**

B.E. END SEM. EXAMINATION, DEC 2015

103 : PHYSICS – I

Time: 3:00 Hrs. Max. Marks: 70

Note: **Q. No.1 is compulsory.** Attempt any other **four questions.**
Assume suitable missing data, if any.
Symbols have their usual meaning.

1. Attempt <u>any seven</u> out of the following: (7x2= 14)
   (a) What is quality factor of an oscillator? How is it affected by the damping? Explain.
   (b) Show that the slope of displacement curve for a travelling wave represents volumetric strain of the medium.
   (c) A body has the dimension represented by $5\,\hat{i} + 3\,\hat{j}$ in reference frame S'. How these dimensions will be represented in S frame if S' frame is moving with 0.6c along +ve x-axis.
   (d) Assume earth to be moving around the sun with a constant speed in a circular orbit. Can we consider it to be an inertial frame of reference? Justify.
   (e) Show that the resultant amplitude at a distant point due to a plane wave front is half of the amplitude due to first half period zone.
   (f) A stationary body explodes into two fragments each of mass 1.0 kg that move apart at speeds of 0.6c relative to the position of original body. Find the mass of the original body.
   (g) Each slit of a double slit has a width of 0.15 mm and the distance between their centres is 0.75 mm. What orders of interference maxima are missing?.
   (h) What are central forces? Show that the angular momentum of particle is conserved under the influence of central force.
   (i) Explain the conditions for getting sustained interference pattern and good contrast interference pattern?

the curve, the x-axis and

2. (a) Discuss the production and detection of plane, circularly and elliptically polarized light. (6)
(b) Explain how a beam of plane polarized light may be regarded as composed of two equal and oppositively circularly polarized lights. Explain the rotation of the plane of polarization of a plane-polarized beam on its passage through an optically active substance. (4)
(c) Calculate the thickness of half wave plate for sodium (λ= 5893 Å), if μ_o= 1.54 and the ratio of velocity of ordinary and extraordinary wave is 1.007. Is the crystal positive or negative? (4)

3. (a) Obtain the expression for the relativistic mass of a body and show its variation graphically with the velocity. Hence justify the un-attainability of the speed of light by a material particle. (5)
(b) Derive an expression for average power dissipation in case of forced oscillation and also find out the condition for power resonance. (5)
(c) Particles of two velocities of 0.8c each are inclined to one another at an angle of 30°. Obtain the value of their relative velocity. (4)

4. (a) Explain the term "half period zone" in relation to a plane wave front. (3)
(b) Sketch and explain the amplitude distribution in the case of Fresnel's diffraction at a straight edge. Also compare the width of 2nd maxima to the 2nd minima. (8+3)

5. (a) Discuss the formation of fringes in Michelson Interferometer with neat diagram. Why circular fringes are formed in normal adjustment? If the d is changed by 2λ, how this fringe pattern will change? (6)
(b) Show that the radii of dark rings formed in Newton's ring arrangement are proportional to square root of natural numbers? (4)
(c) How the circular fringes obtained by Michelson Interferometer differ from that of Newton's rings? (4)

6. (a) Obtain the intensity distribution due to N-slits which is illuminated by monochromatic light of wave length λ and obtain the condition of principal maxima. (7)
(b) Obtain the resolving power of a grating. On what factors the resolving power and dispersive power of a grating depends upon? Explain. (4)
(c) Calculate the number of lines that a grating must have to resolve D_1 and D_2 lines (of wave lengths 5890 A & 5896 A) of sodium in the second order. (3)

7. (a) It is required to make a converging achromatic doublet of equivalent focal length 30 cm for two lenses (in contact) of crown and flint glass of dispersive power 0.2 and 0.3 respectively. Find the focal length of both lenses. (5)
(b) Two identical thin convex lens of focal length 8cm each are coaxial and 4cm apart. Find and locate (with diagram) the equivalent focal points and the principal points for the above lens system. (6)
(c) How spherical and chromatic aberrations are minimized in case of Huygen and Ramsden eye pieces? (3)

8. Write short notes on <u>any Two</u> of the following: (7 x 2)
(a) Reflection and transmission of acoustic wave.
(b) Huygen's construction of wavefronts when optic axis is inclined to refracting surface.
(c) Fundamental interactions
(d) Nicol prism, its construction and working.

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FIRST SEMESTER B.E. (common to all branches)

END SEMESTER EXAMINATION, November-2014

103: PHYSICS I

Time: 3:00 Hrs. **Max. Marks: 70**

Note: *Attempt ANY FIVE questions.*
All questions carry equal marks.
Assume suitable missing data, if any

1. [a] State the fundamental postulates of special theory of relativity. Derive the inverse Lorentz transformation. (2+4)

[b] Show that the momentum of a particle of rest mass m_0 and kinetic energy E_k is given by the expression

$$p^2 = \frac{E_k^2}{c^2} + 2m_0E_k \qquad (4)$$

[c] Show that the circle $x^2 + y^2 = a^2$ in frame S appears to be an ellipse in a frame S' which is moving with velocity v relative to S. (4)

2. [a] Discuss the behavior of the displacement versus driving force frequency in case of a forced oscillator. (5)

[b] Show that for forced oscillator

(i) The displacement at low frequency is independent of frequency

(ii) The resonant frequency of driving force is slightly less than the natural frequency of the oscillator

(iii) Maximum amplitude $A_{max} = \frac{F_0}{r\omega'}$, where r is damping constant and $\omega' = \sqrt{\frac{s}{m} - \frac{r^2}{4m^2}}$, s is spring constant.

(3+3+3)

3. [a] What will happen if a transparent thin sheet is introduced in the path of one of the interfering beams in Biprism? Also find out the expression for the displacement of central bright fringe. (5)

[b] Show that the reflected system and transmitted system of interference pattern in case of a thin film are complementary to each other. (4)

[c] Light containing two wavelengths λ_1 and λ_2 falls normally on a Plano convex lens of radius of curvature R, resting on a plane

glass plate. If the n^{th} dark ring due to λ_1 coincides with the $(n+1)^{th}$ dark ring due to λ_e, show that the radius of the n^{th} dark ring of λ_1 is $\sqrt{\frac{\lambda_1\lambda_e R}{\lambda_1-\lambda_e}}$ (5)

4. [a] Explain the term half-period zone in relation to a plane wavefront. Show that the amplitude due to complete wavefront at a point is half of what would be caused by the first zone. (7)
[b] Describe Fraunhofer diffraction due to a single slit and deduce the positions of maxima and minima. Also show that the relative intensities of successive maxima are approximately

$$1: \frac{4}{9\pi^2} : \frac{4}{25\pi^2} : \frac{4}{49\pi^2}$$ (7)

5. [a] Explain the terms (i) optic axis (ii) double refraction (iii) positive and negative crystal. (2+2+2)
[b] How Nicol prism can be used as polarizer and analyzer? Explain in detail with the help of diagram. (4)
[c] Calculate the thickness of a plate which would convert plane polarized light into circularly polarized light. Given: λ=5890A°, μ_o=1.658, μ_e=1.486 (4)

6. [a] Define acoustic impedance and obtain an expression for it. Discuss reflection and obtain an expression for it. Discuss reflection and transmission of sound waves at the interface of two media. (7)
[b] Discuss spherical and chromatic aberration of a lens. How would you correct for chromatic aberration? (4+3)

7. Write short notes on any four of the following: (3.5×4)
[a] Kepler's law of planetary motion
[b] Proper time and time dilation
[c] Fringes of equal thickness and equal inclination
[d] Missing order in Double Silt Diffraction
[e] Resolving Power of Grating
[f] Comparison between Zone plate and Convex Lens

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Total No. of Pages: Roll No.....

FIRST SEMESTER B.E (EC/COE/ICE/MPAE/IT/BT)

END SEMESTER EXAMINATION, November – 2012

103 PHYSICS-I

Time: 3 hrs Max. Marks: 70

Note. Attempt total five questions including Q.1 which is compulsory.
All questions carry equal marks. Assume suitable missing data, if any.

Q.1

a) What are massless particles? Show that the massless particles can exist only if they move with the speed of light and their energy (E)and momentum(p) must have the relation. E=pc.

b) On the basis of Huygens theory of double refraction, draw the wavefronts of o-ray and e-ray for positive and negative crystals indicating the optic axis.

c) A randomly polarized light of 100W/m² is passed through a polarizer having pass axis at an angle 60° with the vertical. What will be the intensity of emergent light.

d) Why does excessively thin film of liquid (μ_l) floating on the water (μ_w) appear bright in reflected light? Given $\mu_l < \mu_w$.

e) What are the differences between the circular fringes obtained in the Newton's ring experiment and Michelson Interferometer.

f) If half of the grating width is covered how will it affect the width of principal maxima. How many orders will be observed by a grating having 4000 lines/cm. if it is illuminated withlight of wavelength in the range 5000Å to 7500Å.

Q.2

a) Show that the second postulate of special theory of relativity is not satisfied by Galilean transformation. 3

b) Find the speed of 0.1 MeV electrons according to classical and relativistic mechanics. 3

c) Show how the relativistic invariance of law of conservation of momentum leads to the concepts of variation of mass with velocity and the equivalence of mass and energy.

d) A circular lamina moves with its plane parallel to XY plane of a refernce frame S at rest. Assuming its motion to be along X axis, calculate the velocity at which its surface area would appear to be reduced to half to an observer in the frames at rest.

Q.3

a) In Newton's ring experiment, what happens when, 5
   1) glass plate is replaced by a plane mirror
   2) lens is lifted up from the flat surface slowly
   3) monochromatic light is replaced by white light
   4) How can one change the centre from dark to bright for reflected light without moving the lens.

b) Discuss the phenomenon of interference of light due to thin film and find the condition of maxima and minima. Show that under the illumination with

monochromatic light the interference patterns in reflected and transmitted light are complementary. What happens when it is illuminated with white light? 5

c) In a biprism experiment, the distance between the slit and the screen is 160.0 cm. the biprism is 40cm away from the slit and its refractive index is 1.52. When the source of wavelength 5893°A is used, the fringe width is found to be 0.01cm. Find the angle of prism. 4

Q.4

a) Write the intensity expressions for single and double slit diffraction and also plot their intensity patterns. Calculate the intensity ratio of first maxima and central maxima in single slit diffraction. 6

b) What do you understand by missing order spectrum in double slit diffraction pattern? What particular spectra would be absent if the width of transparencies and opacities are equal. 4

c) A diffraction grating is just able to resolve two lines of wavelengths 5140.34°A and 5140.85°A in the first order. Will it resolve the lines 8037.20°A and 8037.50°A in the second order? 4

Q.5

a) What is zone plate? Derive an expression for its focal length and compare its performance with that of converging lens. 6

b) In the diffraction pattern due to a straight edge the separation between the first two maxima above the edge of the geometrical shadow was found to be 8×10^{-4} m when screen as well as the source were at a distance of 1m from the edge. Calculate the wavelength of light emitted by the source. 6

c) What are Fresnel's Half Period Zones? 2

Q.6

a) How would you produce and detect the following with the help of Nicol prism and Quarter wave plate.
Plane polarized light, circularly polarized and elliptically polarized light. 6

b) What is Specific rotation? Explain the construction and working of Laurent's Half Shade Polarimeter. 5

c) The impure sugar weighing 20gm is dissolved in 150cc of water. It gives an optical rotation of 10° when polarimeter tube of length 20cm is used. If specific rotation of sugar is 66°cc /dm g, determine percentage impurity of sugar. 3

Q.7

a) Prove that in the steady state of a driven oscillator the average power supplied by the driving force equals that being dissipated against the frictional force. 6

b) If the relaxation time for damped harmonic oscillator is 50 sec, find the time in which
   i) The amplitude falls to 1/e times of the initial value
   ii) Energy of system falls to $1/e^4$ times the initial value. 6

c) Derive the expression for energy density of plane progressive wave 2

Q.8 Write short notes on of the following (any two)
a) Explain Keplers law of planetary motion. b) Working of Ramsden's and Huygens eyepiece c) Characteristics of central forces. d) Invariance of physical quantities. 14
e) Fresnel's biprism and its working.

Total No. of Page(s): 03

FIRST SEMESTER Roll No. 416/GT

(ALL) **B.E.**

B.E. END SEM. EXAMINATION, Nov.-Dec. 2011

103 : PHYSICS – I

Time: 3:00 Hrs. Max. Marks: 70

Note: Attempt any FIVE questions.
Assume suitable missing data, if any.

1. **[a]** Assume earth to be moving around the sun with a constant speed in a circular orbit. Can we consider it to be an inertial frame of reference? Justify. [4]

[b] A spaceship moving away from the earth with velocity 0.6c fires a rocket whose velocity relative to the spaceship is 0.9c (i) away from the earth (ii) towards the earth. What will be the velocity of rocket as observed from the earth in the above cases? [3+4]

[c] Why do we not observe the effect of time-dilation in every day phenomena? [3]

2. **[a]** Frame S' is moving with velocity v_1 w.r.t. S, and frame S'' is moving with velocity v_2 w.r.t. S' along the same direction. Prove that the successive Lorentz transformation from S to S' and from S' to S'' are equivalent to a single transformation from S to S''. Calculate the relative velocity (v) of S'' w.r.t. S for the values $v_1 = 0.8C$ and $v_2 = 0.9C$. [6+2]

[b] A stationary body explodes into two fragments each of mass 1.0 kg that move apart at speeds of 0.6c relative to the position of original body. Find the mass of the original body. [4]

[c] Does photons have mass? If no, then how photons have momentum? [2]

3. **[a]** Solve differential equation of a harmonic oscillator subjected to a sinusoidal force and obtain conditions for amplitude resonance & power resonance Draw the plots between the following: (i) amplitude versus driving frequency and (ii) average power observed versus driving frequency. Compare two plots. [6+3]

[b] Why the volumetric strain of the medium is represented by the slope of a plot between displacement and distance for a wave traveling along +ve x-direction in the same medium? What are the conditions of perfect impedance matching between two acoustic media? [3+2]

4. [a] Explain the formation of circular fringes in Newton's ring experiment with suitable diagram and compare these fringes with the circular fringes of Michelson interferometer. [3+2]

[b] A shift of 200 circular fringes is observed, when a movable mirror of Michelson interferometer is shifted by 0.59 mm. Calculate wavelength of light. [4]

[c] What are the conditions for getting sustained interference pattern and good contrast interference pattern? In the Young's double hole experiment, calculate I/I_{max}, where I represents the intensity at a point where the path difference is $\lambda/5$. [2+3]

5. [a] What is Fresnel's half period zone? Show that the amplitude at a point due to a complete plane wavefront is half of the amplitude due to first half period zone. [4]

[b] Explain with suitable ray diagram the intensity variation in illuminated region in case of Fresnel's diffraction due to straight edge. [6]

[c] Compare a single slit diffraction pattern with a double slit diffraction pattern. What are missing orders? [3+1]

6. [a] How would you ascertain the correct state of polarization (i.e. circularly, elliptically, plane, un-polarized, mixture etc.)of an unknown incoming beam of light with the help of a rotating nicol prism and a quarter wave plate? [7]

[b] How would you differentiate positive and negative crystals in terms of velocity of light and refractive index in all directions w.r.t. optic axis with examples? Draw a neat ray diagram using Huygen's construction for a doubly refracting positive crystal with optic axis parallel to the refracting surface and perpendicular to your answer sheet for oblique incidence. [3+4]

7. [a] Explain the rotation of plane of polarization of a plane polarized light on its passage through an optically active substance. [3]

[b] How would you confirm whether the grating equation represents diffraction max/min or interference max/min? Explain Rayleigh criterion for just resolution of spectral lines. Obtain an expression for resolving power of a grating. [2+2+4]

[c] It is required to make a converging achromatic doublet of equivalent focal length 30cm for two lenses (in contact) of crown and flint glass of dispersive power 0.2 and 0.3 respectively. Find the focal length of lenses? [3]

8. Write short notes on **any two** of the following:

[a] Cardinal points of Huygen' and Ramsden eyepiece

[b] Conservative and non-conservative forces.

[c] Invariance and symmetry principle

[d] Invariance of space-time interval. [7+7]

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