QP CODE: 23127000

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B.Sc DEGREE (CBCS) REGULAR / IMPROVEMENT / REAPPEARANCE EXAMINATIONS, OCTOBER 2023

Third Semester

Core Course - PH3CRT03 - OPTICS, LASER AND FIBER OPTICS

Common to B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

AD7B1113

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Is it necessary that the interfering waves should have the same frequency to get sustained interference pattern. If so why?
2. Why an excessively thin film appears black in reflected light?
3. Write the condition for obtaining dark fringes in interference pattern due to transmitted light.
4. What will happen if wedge shaped film is placed in white light?
5. Distinguish between single slit and double slit diffraction pattern.
6. Brewster's law is not applicable for metallic surfaces. Why?
7. Define optic axis and principal plane of a crystal.
8. What is optical activity?
9. Name three properties that make laser light differ from ordinary light.
10. What is optical pumping?
11. Explain critical angle of an optical fibre.
12. What is a single mode fiber?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. The intensities of the maxima and minima and interference fringe pattern are in the ratio 16:9. Calculate the ratio between amplitude and intensities of 2 interfering beams.

14. Distance between the two slits is 0.1mm and the width of the fringes formed on the screen is 5mm. If the distance between the screen and the slit is one metre, calculate the wavelength of light used.

15. In a Newton's ring experiment the diameter of the 5^{th} dark ring is 0.336cm. The wavelength of light used is 588nm. Find the radius of curvature of lens.

16. A monochromatic light of 589 nm, located at a distance of 0.1m from a straight edge is allowed to incident on it. If the screen is kept at a distance of 0.5m from the edge, calculate the distance between the first and the second dark band.

17. Consider a circular aperture of diameter 2.2 mm illuminated by a plane wave. The most intense point on the axis is at a distance of 200 cm from the aperture. Calculate the wavelength.

18. Calculate the thickness of ice required to act like a half a plate for a wavelength of 590 nm. The refractive Indices for the ordinary and extraordinary rays are 1.309 and 1.313 respectively.

19. Draw a labelled energy level diagram and discuss the various transitions for three level and four level laser schemes.

20. Give a qualitative idea of formation and reconstruction of a hologram.

21. A signal of 100 mW is injected into a fiber. The outcoming signal from the other end is 40 mW. What is the loss in dB?

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. With a neat diagram explain the principle and working of a Michelson's interferometer.

23. Using Fraunhofer theory of diffraction at a single slit, explain the diffraction by multiple slits(N-Slits).

24. Describe the process of production of plane polarized light by reflection. State Brewster's law and give its significance and applications. What does the law become when the ray travel from denser to rarer medium?

25. (i) Derive Einstein's relations and write its inferences.
(ii) Why is it difficult to achieve laser action in X-rays?

(2×10=20)

23104207

QP CODE: 23104207

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) REGULAR / IMPROVEMENT / REAPPEARANCE EXAMINATIONS, JANUARY 2023

Third Semester

Core Course - PH3CRT03 - OPTICS, LASER AND FIBER OPTICS

Common to B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

45EB6208

Time: 3 Hours Max. Marks : 60

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Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. What are the conditions for producing sustained interference pattern?
2. Distinguish between optical path difference and geometrical path difference
3. Write the condition for obtaining bright fringes in interference pattern due to transmitted light ?
4. An airwedge formed between two glass plates is illuminated with a monochromatic light and viewed from the top. What will be the qualitative difference in the fringe pattern when it is immersed in an oil of refractive index 1.7?
5. Eventhough you cannot see someone around the corner of an open doorway, you can hear them speaking. Explain.
6. What is meant by grating element?
7. Define optic axis and principal plane of a crystal.
8. What is optical activity?
9. Can we achieve population inversion by simply heating the material? Justify your answer

10. “There could be no population inversion and laser action in a medium if there is no metastable state”. Explain

11. What is meant by spiking in ruby laser ?

12. Data carrying capacity of optical fiber is more than that of radio waves.Why?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. A light source emit two lights of wavelength 430nm and 510nm. The source is used for a double slit experiment. The distance between the source and screen is 1.5m and the distance between the two slits is 0.025mm. Calculate the separation between the 3rd order bright fringes due to these 2 wave lengths

14. Why are camera lenses coated to make them non reflecting?

15. In a Newton’s ring experiment the diameter of 11^{th} ring changes from 1.40 cm to 1.271 cm when a drop of liquid is introduced between the lens and the glass plate. Calculate the refractive index of the liquid.

16. A zone plate is illuminated with a monochromatic light of wavelength 589 nm placed at a distance of 1 m. If the image of point source is obtained at a distance of 2m on the other side, what will be the power of equivalent lens which may replace the zone plate without disturbing the setup? Also find the radius of the first zone of the plate.

17. The critical angle of incidence for total reflection in case of water is 48^0. What is its polarizing angle? What is the angle of refraction corresponding to the polarizing angle?.

18. What will be the Brewster angle for a glass slab of refractive index 1.5 immersed in water of refractive index 1.33.

19. A laser source with output power 1mW emits a wavelength of 630nm. Calculate the number of photons emitted per second. If the area of laser beam is 10^{-6} m^2 , then find intensity of laser beam.

20. Find the fractional refractive index and numerical aperture for an optical fiber with refractive indices of core and cladding as 1.5 and 1.49 respectively. Also find the numerical aperture and acceptance angle of the fiber. Hence find whether the fiber is step index or graded index.

21. Discuss the different attenuation mechanisms in fibers.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. With a neat diagram explain the principle and working of a Michelson's interferometer.

23. Explain qualitatively the pattern due to Fresnel diffraction at a single slit for the case of narrow and wide slits. Compare it with the pattern for a straight edge

24. What is the essential condition for having Fraunhofer diffraction. Discuss the intensity distribution due to diffraction at a double slit and find the positions of maxima and minima.

25. What are Einstein's coefficients? Show that the probabilities of stimulated emission and stimulated absorption are the same.

(2×10=20)

QP CODE: 22100532

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Name : .....

B.Sc DEGREE (CBCS)REGULAR / REAPPEARANCE EXAMINATIONS, APRIL 2022

Third Semester

Core Course - PH3CRT03 - OPTICS, LASER AND FIBER OPTICS

Common to B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

A7E4A114

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Can interference occur with sound waves? Explain.
2. In a double slit experiment, what will happen to the interference pattern if the slit seperation is increased?
3. Write the condition for obtaining dark fringes in interference pattern due to transmitted light.
4. What will happen in Newton's rings experiment when air in the interface is replaced with a transparent liquid?
5. State two differences between interference and diffraction.
6. The fifth secondary maximum is not obtained in the diffraction pattern of a double slit. What should have been the ratio of the slit width to slit seperation?
7. Brewster’s law is not applicable for metallic surfaces. Why?
8. Write any two methods for producing plane polarized light.
9. Can we obtain light amplification in the absence of stimulated emission? Explain.
10. What are requirements for population inversion and laser action?
11. Draw the energy level diagram of a three level laser system.
12. What are the basic parts of an optical fiber?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. A parallel beam of light of wavelength 589nm is incident on a glass plate having refractive index μ=1.5 such that the angle of refraction in the plate is 60^0. Calculate the smallest thickness of glass plate which will appear dark by reflected light.

14. A wedge shaped air film, having an angle of 40 seconds is illuminated by monochromatic light and fringes are observed vertically through a microscope. The distance measured between the consecutive bright fringes is 0.12×10^{-2} m. Calculate the wavelength of light used.

15. A shift of 100 circular fringes is observed, when the movable mirror of Michelson's interferometer is shifted by 0.0295mm.Calculate the wavelength of light.

16. If a zone plate has to have a principle focal length of 50cm corresponding to wavelength $6x10^{-5}$cm, obtain an expression for the radii of different zones. What would be its principal focal length for wavelength= $5x10^{-5}$ cm?

17. What will be the Brewster angle for a glass slab of refractive index 1.5 immersed in water of refractive index 1.33.

18. a) Is it possible to convert a half wave plate to a quarter wave plate? Explain.
    b) A half waveplate constructed for a wavelength 380 nm . For what wave length does it work as a quarter wave plate?

19. What is the population ratio between two energy levels in thermal equilibrium? A He-Ne laser has an emission wavelength of 639 nm at 300 K. Find the ratio of populations of the two states in this laser.

20. The total number of lasing particles (ions, electrons, holes etc.) in a laser are $2{\cdot}8\times10^{19}$. If the Laser emits radiation of wavelength 700_{nm}, then calculate the energy of one emitted photon and total energy available per pulse. Assume the efficiency of Laser as 100%.

21. A step index fiber has a core diameter 29mm, refractive index 1.52 and fractional refractive index of 0.0007. It is operated with a wavelength of 1.3 mm. Find the normalized frequency or V number of the fiber and the number of modes the fiber will support.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. State the principle of superposition of waves. Define interference and derive the conditions for I_{max} and I_{min}. What do you mean by 'visibility of fringes'?

23. With the help of a neat diagram explain the Fresnel diffraction at a straight edge. Show that the separation between successive maxima goes on increasing along the region of the geometric shadow . Also obtain the expression from wavelength of incident light.

24. Obtain the expression for intensity distribution of a monochromatic light in a Fraunhofer diffraction at a single slit. Identify the maxima and minima of the distribution.

25. A step index fiber with core diameter of 30 and μm n_1 =1·530 and n_2 =1·515 show absorption of 0.0002% of incident power at each reflection on the core-clad boundary. Find the attenuation in dB/km for a ray suffering 10^6 reflections in a fiber length of 1km. Assume that there are no other losses.

(2×10=20)

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B.Sc DEGREE (CBCS)EXAMINATION, AUGUST 2021

Third Semester

Core Course - PH3CRT03 - OPTICS, LASER AND FIBER OPTICS

Common to B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

A7CD392D

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. State the principle of superposition of light waves.
2. If two coherent sources are separated by a distance less than a wavelength of light, what will happen to the interference pattern?
3. Write the condition for obtaining dark fringes in interference pattern due to transmitted light ?
4. What is the condition for producing circular fringes using Michelson's interferometer?
5. Eventhough you cannot see someone around the corner of an open doorway, you can hear them speaking. Explain.
6. Distinguish between prism spectra and grating spectra.
7. What happens when an elliptically polarized light passes through a quarter wave plate?
8. What is optical activity?
9. Why is laser action not possible in a two level gas laser system?
10. He-Ne Laser is considered superior to Ruby Laser. Why?
11. Write any two applications of laser.
12. What is a multimode fiber?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. A single slit is illuminated by a monochromatic light source. A screen is placed 5.0 m away from this slit and two very narrow, parallel slits, 0.5 mm apart, are placed half way between the single slit and the screen. Interference fringes are visible on the screen with 10 fringe spaces measure 20 mm on the screen. **a)** What is the wavelength of the light? **b)** What happens if you use double slits with half the spacing between them? **c)** What happens if you cover one of the double slits?

14. When a thin soap film of refractive index 1.34 is observed by light of wavelength 589.3nm reflected normally, it appears black. Find the minimum thickness of the film.

15. Fringes of equal thickness are observed in a thin glass wedge of refractive index 1.52. The fringes spacing is 1mm. Wavelength of light is 589.3nm. Find the angle of the wedge.

16. A monochromatic light of 589 nm, located at a distance of 0.1m from a straight edge is allowed to incident on it. If the screen is kept at a distance of 0.5m from the edge, calculate the distance between the first and the second dark band.

17. Explain why the intensity of the secondary maxima become weaker with the increasing order of secondary maxima in diffraction.

18. Prove that when the angle of incidence corresponds to the Brewster angle, the reflected and refracted rays are at right angles to each other.

19. Discuss various pumping methods used in the Lasers for obtaining population inversion.

20. A glass fiber has a core material of refractive index 1.46· and cladding material of refractive index of 1·42 . If it is surrounded by air, compute the critical angle (i) at core cladding boundary (ii) at cladding air boundary

21. An optical fiber of 1 mW is launched into an optical fiber of length 100 cm. If the power emerging from the other end is 0.3mW, calculate the fiber attenuation.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. What are Newton's rings? How are they formed? Derive an expression for the radius of the m^{th} dark ring formed by reflection. Also obtain the expression to determine the wavelength of monochromatic light using Newton's rings..

23. What is a zone plate? Explain Fresnel zone construction for a plane wave front and compare it with a convex lens. Show that the amplitude due to complete wavefront is the sum of the amplitudes of odd numbered zones when zone plate is used.

24. Describe the phenomenon of birefringence. With neat diagrams, discuss Huygens's theory of double refraction through uniaxial crystals.

25. (i) Derive Einstein's relations and write its inferences. (ii) Why is it difficult to achieve laser action in X-rays?

(2×10=20)

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B.Sc. DEGREE(CBCS) EXAMINATION, OCTOBER 2019

Third Semester

B.Sc Physics Model I

CORE COURSE - PH3CRT03 - OPTICS, LASER AND FIBER OPTICS

(Common to B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications, B.Sc Physics Model III Electronic Equipment Maintenance)

2017 Admission Onwards

588E4DD5

Maximum Marks: 60 Time: 3 Hours

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Can interference occur with sound waves? Explain
2. Oil spread on the surface of water appears colored. Why?
3. Write the condition for obtaining bright fringes in interference pattern due to transmitted light ?
4. How would you obtain Newton's rings with bright centre?
5. Distinguish between interference and diffraction
6. What is a plane diffraction grating?
7. What are polaroids?
8. What is the disadvantage of retardation plates?
9. Write any two methods to produce population inversion
10. The efficiency of a four level laser is less than that of a three level laser. Still the four level laser is better than the three level laser. Explain
11. Write two characteristics of a laser beam
12. What is the basic principle of guiding light through an optical fiber?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. The intensities of the maxima and minima and interference fringe pattern are in the ratio 16:9. Calculate the ratio between amplitude and intensities of 2 interfering beams.

14. Two narrow and parallel slits 0.1 cm apart are illuminated with a monochromatic light of wavelength 589.3nm. The interference pattern is observed at a distance of 25cm from the slits. Calculate the fringe width.

15. A shift of 100 circular fringes is observed, when the movable mirror of Michelson's interferometer is shifted by 0.0295mm.Calculate the wavelength of light.

16. A convex lens of focal length 20cm is placed after a slit of width 0.6mm. If a plane wave of wavelength $6000A^0$ falls normally on the slit, calculate the separation between the second minima on either side of the central maximum.

17. A ray of light is incident on the surface of a plate of glass of refractive index 1.62 at the polarizing angle. Calculate the angle of refraction

18. Calculate the thickness of a calcite plate which would convert plane polarized light into circularly polarized light. Wavelength of light used is 589nm. Refractive index of calcite for Oray is 1.658 and that of e-ray is 1.486

19. At what temperature are the rays of spontaneous and stimulated emission equal if the wavelength l of emitted photon 500nm. If the temperature is 300K at what wavelength they are equal

20. Find the relative population of two states in a Ruby laser that produces light beam of wavelength 694.3nm at 300K.

21. What ido you mean by modes of propagation? Compare a single mode and multimode fiber.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Explain the formation of interference fringes formed by an air wedge. Derive an expression for the fringe width. How can the above method used for determining the diameter of thin wire accurately

23. Show that the radii of its half period zones are proportional to the square root of natural numbers. Derive an expression for its focal length. Aslo show that for a given wavelength, zone plate has multiple foci.

24. Explain the Fraunhofer diffraction at double slits and compare the intensity distribution pattern with that of a single slit.

25. Write names of various losses taking place in the optical fiber. If the length of optical fiber is 6km and output power is 1/120 of input power, then find fiber loss and attenuation coefficient.

(2×10=20)

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Reg No : .....

Name : .....

B.Sc. DEGREE(CBCS) EXAMINATION, NOVEMBER 2018

Third Semester

B.Sc Physics Model I

CORE COURSE - PH3CRT03 - OPTICS, LASER AND FIBER OPTICS

(Common to B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications, B.Sc Physics Model III Electronic Equipment Maintenance)

2017 Admission Onwards

7BB61628

Maximum Marks: 60 **Time: 3 Hours**

Part A

Answer any **ten** questions.

Each question carries **1** mark.

1. Is it necessary that the interfering waves should have the same frequency to get sustained interference pattern? If so why?
2. Is it possible to observe interference pattern with light emanating from two independent sources? Why?
3. Write the condition for obtaining bright fringes in interference pattern due to transmitted light ?
4. How can you obtain straight line fringes using Michelson's interferometer?
5. Plot the intensity distribution of Fresnel's diffraction at a straight edge
6. Distinguish between single slit and double slit diffraction pattern
7. Mention two applications of polaroids
8. What is a quarter wave plate?
9. Define photolithography
10. Why core material is having a higher refractive index than that of cladding?
11. What do you mean by index profile of optical fiber?
12. Distinguish between coherent and incoherent fiber bundle

(10×1=10)

Part B

Answer any **six** questions.

Each question carries **5** marks.

13. A parallel beam of light strikes an oil m=1.4 film floating in surface of water with m=1.33. When viewed at an angle 300 from the normal 6th dark fringe is seen. Find the thickness of the film, if wavelength of light is 589nm

14. A wedge shaped air film, having an angle of 40 seconds is illuminated by monochromatic light and fringes are observed vertically through a microscope. The distance measured between the consecutive bright fringes is 0.12×10^{-2} m. Calculate the wavelength of light used.

15. In a Newton's ring experiment the diameter of the 5^{th} dark ring is 0.336cm. The wavelength of light used is 588nm. Find the radius of curvature of lens.

16. Show that the area of all half period zones in a zone plate is a constant. For a zone plate of focal length 50 cm and an incident wavelength of 640 nm, find the radius of the first and 9^{th} half period zones.

17. *In an arrangement of Fraunhofer diffraction, with a slit width of 0.2mm , the first minimum is at 5mm on either side of the central maximum. If the distance between the lens and screen is 2 m, calculate the wavelength of light.*

18. Calculate the thickness of a calcite plate which would convert plane polarized light into circularly polarized light. Wavelength of light used is 589nm. Refractive index of calcite for Oray is 1.658 and that of e-ray is 1.486

19. What fraction of atoms is in the excited state in a laser medium at temperature 300°C? Given λ = 590nm.

20. At what temperature is the rate of spontaneous and stimulated emissions equal? Given λ = 500nm

21. A typical helium –neon laser radiation of wavelength 632.8nm. Howmany photons per second would be emitted by a 1 mW helium neon laser?

(6×5=30)

Part C

Answer any **two** questions.

Each question carries **10** marks.

22. Discuss the conditions for interference. Describe Young's experiment and derive an expression for (i) intensity at a point on the screen and (ii) fringe width.

23. Explain the theory of plane transmission grating. How can you determine the wavelength of monochromatic light using grating?

24. Distinguish between plane polarised and unpolarised light. Discuss the production and detection of plane, circularly and elliptically polarized light

25. What are the essential requirements and various steps involved for the producing laser action.? Explain the components of a laser. Discuss the important applications of lasers

(2×10=20)