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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Examination, July 2020

Programme: BSc. (H) Physics	**Semester : II**
Course Name: Waves and Optics	**Max. Marks : 100**
Course Code: Phys 1014	**Attempt Duration : 3 Hrs.**
No. of page/s:	

Note:

1. Read the instruction carefully before attempting.
2. This question paper has two section, Section A and Section B.
3. There are total of six questions in this question paper. **One** in **Section A** and **five** in **Section B**
4. **Section A** consist of multiple choice based questions and has the total weightage of 60%.
5. **Section A** will be conducted online on BB Collaborate platform
6. **Section B** consist of long answer based questions and has the total weightage of 40%. The questions for section B shall also appear in BB Collaborate
7. **Section B** is to be submitted within 24 hrs from the scheduled time i.e. if the examination starts at 10:00 AM, the long answers must be submitted by 09:59:59 AM next day. Similarly, if the examination starts at 2:00 PM it must be submitted by 01:59:59 PM next day. (*Exceptional provision due extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas*)**.**
8. No submission of **Section B** shall be entertained after 24 Hrs.
9. **Section B** should be attempted after **Section A**
10. **Section B** should be attempted on blank white sheets (hand written) with all the details like programme, semester, course name, course code, name of the student, Sap id at the top (as in the format) and signature at the bottom (right hand side bottom corner)
11. Both section A & B should have questions from entire syllabus.
12. The COs mapping, internal choices within a section is same as earlier

Section – A (Attempt all the questions)

(60 marks)

1. This question carries 40 parts including multiple choice, multiple answer and true/false type questions. All questions are compulsory. Q 1 to Q 25 carry 1 mark each, Q 26 to Q 35 carry 2 marks each and Q 36 to Q 40 carry 3 marks each

1. How many lenses are used in Fraunhofer Diffraction? a) Two Convex lenses b) Two Concave lenses c) One Convex lens d) No lens used	**1**	**CO1**
2. In Fresnel Diffraction, the incident wavefront is _____ a) Hyperbolic b) Linear c) cylindrical d) Elliptical	**1**	**CO1**
3. In Double Slit Fraunhofer Diffraction, some orders of interference pattern are missing. It is called _____ a) Missing Spectra b) Absent Spectra c) End Spectra d) Emission Spectra	**1**	**CO1**
4. Which of the following does not show any interference pattern? a) Soap bubble b) Excessively thin film c) A thick film d) Wedge Shaped film	**1**	**CO1**
5. The main principle used in Interference is _____ a) Heisenberg's Uncertainty Principle b) Superposition Principle c) Quantum Mechanics d) Fermi Principle	**1**	**CO1**
6. When Two waves of same amplitude add constructively, the intensity becomes _____ a) Double b) Half c) Four Times d) One-Fourth	**1**	**CO2**

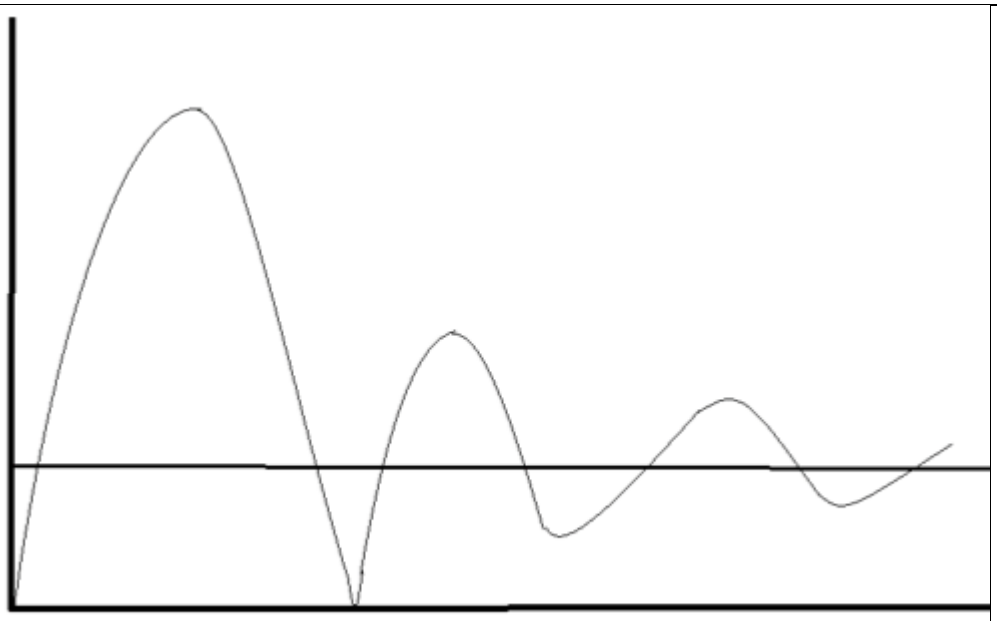
7. If instead of monochromatic light white light is used for interference of light, what would be the change in the observation? a) The pattern will not be visible b) The shape of the pattern will change from hyperbolic to circular c) Colored fringes will be observed with a white bright fringe at the center d) The bright and dark fringes will change position	**1**	**CO2**
8. Interference is observed only when the phase difference between the two waves is zero. a) True b) False	**1**	**CO1**
9. The shape of the pattern depends on the _____ a) Distance between the slits b) Distance between the slits and the screen c) Wavelength of light d) Shape of the slit	**1**	**CO1**
10. If the separation between the two slits in Double Slit Fraunhofer Diffraction is changed, what change will be observed in the diffraction pattern? a) The fringe length will increase b) The fringe length will decrease c) Fringes will be colored d) No change	**1**	**CO2**
11. In Fresnel diffraction, the relative phase difference between the curved wavefront is _____ a) Constant b) Zero c) Linearly increasing d) non-constant	**1**	**CO2**
12. The radius of the half period zone is proportional to _____ a) The wavelength of light b) The square root of the frequency of light c) The square root of the wavelength light d) The frequency of light	**1**	**CO2**

13. The zone plate behaves like a _____ a) Concave Lens with multiple foci b) Convex Lens with multiple foci c) Convex Lens with single foci d) Concave Lens with single foci	**1**	**CO2**
14. Zero order fringe can be identified using _____ a) White light b) Yellow light c) Achromatic light d) Monochromatic light	**1**	**CO2**
15. The shape of the fringes observed in interference is _____ a) Straight b) Circular c) Hyperbolic d) Elliptical	**1**	**CO1**
16. According to stoke's law, the expression for maxima is: 2μtcosr = _____ a) nλ b) 2nλ c) (2n + 1) λ/2 d) (n + 1) λ/2	**1**	**CO2**
17. The interference pattern of soap bubble changes continuously. a) True b) False	**1**	**CO1**
18. The displacement of a particle in SHM in one time period is a) a b) 2a c) zero d) a/2	**1**	**CO2**
19. Second glass plate in Michelson 's Interferometer is known as A. Extra glass plate C. Simple Glass Plate B. Compensating glass plate D. None of these	**1**	**CO1**
20. In reflected light the central fringes of Newton's ring is A. dark B. Bright C. Uniform D. Non uniform	**1**	**CO2**

21. As a wave travels down a spring, the amplitude slowly decreases. Why does this occur? A. The law of conservation of energy does not apply to waves. B. The energy is spread out along the entire length of the spring. C. The wave slows down as it travels along the spring. D. Some energy is lost due to friction as the particles in the spring rub against each other. E. all of the above	**1**	**CO2**
22. Resolving power of grating is given by A. λ/2 B. λ/dλ C. dλ/λ D. none of these	**1**	**CO2**
23. The path difference corresponding to a phase difference of π radian is _____. A.2λ B .λ/2 C .λ /4 D. λ	**1**	**CO2**
24. If we narrow the distance between two slits in Young's experiment the fringes width _____. A. Increases B. Decreases C. Remains same D. becomes zero	**1**	**CO2**
25. In Fraunhofer diffraction pattern due to single slit central maxima is formed at center because: A. Lens focuses all the diffracted rays at the centre of the slit B. Slit focuses all the diffracted rays at the centre of the slit C. Light rays focused at the centre of the screen undergo constructive interference D. Slit and lens both combined focuses the rays at the centre of the slit	**1**	**CO2**

26. In Newton's ring experiment, the diameter of the 10th ring changes from 1.40 to 1.23 cm when a liquid is introduced between the lens and glass plate. What is the refractive index of the liquid? a) 1.05 b) 1.15 c) 1.3 d) 1.35	**2**	**CO3**
27. The total energy of a particle executing simple harmonic motion is proportional to- a) x b) x^2 c) independent of x d) x^(1/2)	**2**	**CO2**
28. Two simple motions are represented by y1=5(sin2πt+√3 cos2πt) y2=5sin(2πt+π/4) The ratio of the amplitude of two simple harmonic motions is?" a) 1:2 b) 2:2 c) 2:1 d) 1:1	**2**	**CO3**
29. Select the correct statement(s). More than one choice may be correct. a) A simple harmonic motion is necessarily periodic. b) A simple harmonic motion is necessarily oscillatory. c) An oscillatory motion is necessarily periodic. d) A periodic motion is necessarily oscillatory.	**2**	**CO2**

30.A thin sheet of refractive index 1.5 and thickness 1 cm is placed in the path of light. What is the path difference observed? a) 0.003 m b) 0.004 m c) 0.005 m d) 0.006 m	**2**	**CO3**
31. The interference in thin films is observed because (select all that apply) (a) The film reflects some light (b) The film is thin enough so that refracted ray is close to reflected ray (c) The reflected ray undergo path change of λ/2 (d) Film is thin not thick	**2**	**CO2**
32. A beam of white light is passed through a diffraction grating and the resulting spectrum is allowed to fall on a screen. Which one of the following is the color of light that undergoes the least deviation from its original direction? Is it: A. Red B. yellow C. Blue D. violet	**2**	**CO3**
33. The graph shown in figure represents what?	**2**	**CO4**

 Number of exposed zones a. Amplitude variation with the number of exposed zones b. Intensity variation with the number of exposed zones c. Frequency variation with the number of exposed zones d. Phase variation with the number of exposed zones		
34. Lloyd's mirror is an example of (select all that apply) A division of wavefront B division of amplitude C interference by reflection D path difference due to Stoke's theorem	**2**	**CO2**
35. Example of fringes of equal thickness are (select all that apply) a) Wedge shaped thin film b) Fabry Parot Interferrometer c) Fresnel biprism d) Newton's rings	**2**	**CO2**

36. Light of 5000 Å is incident on a circular hole of radius 1 mm. How many half period zones are contained in the circle if the screen is placed at a distance of 1 m? a) 20 b) 200 c) 2000 d) 20000	**3**	**CO3**
37. Light of 6000 Å is incident on a circular hole and is received on a screen 100 cm away. What is the radius of the hole, if the intensity of light on the screen is 4 times the intensity without the hole? a) 0.025 cm b) 0.047 cm c) 0.077 cm d) 0.089 cm	**3**	**CO3**
38. Find the missing order for a double-slit Fraunhofer Diffraction pattern if the slit widths are 0.3 mm separated by 0.6 mm. a) 1st, 5th, 9th, …. b) 2nd, 6th, 10th, … c) 3rd, 6th, 9th, …. d) 4th, 8th, 12th, …	**3**	**CO3**
39. When a thin plate of refractive index 1.5 is placed in the path of one of interfering beams of Michaelson Interferometer, a shift of 30 fringes is observed. If the thickness of plate is 0.018 mm, the wavelength of the used light is _____ a) 4000 Å b) 5000 Å c) 6000 Å d) 7000 Å	**3**	**CO3**
40. A screen is placed 1m away from the lens to obtain the diffraction pattern in the focal plane of the lens in a single slit diffraction experiment. What will be the slit width if the first minimum lies 5 mm on either side of the central maximum when plane light waves of wavelength 4000 Å are incident on the slit? a) 0.16 mm	**3**	**CO3**

b) 0.08 mm c) 0.36 mm d) 0.46 mm		

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Section – B (Attempt all the questions)
(40 marks)

2	Derive the expressions for reflection and transmission coefficients for a transverse wave at a boundary between two strings.	**8**	**CO2**
3	Explain with necessary theory the Newton's rings method of measuring the wavelength of light.	**8**	**CO1**
4	For Fraunhoffer diffraction at a single slit, plot the graphs for $y=\alpha$ and $y=\tan\alpha$ and show the positions of secondary maxima.	**8**	**CO4**
5	A 5 Newton tension produces 5 loops in the transverse vibration of a stretched string. How many loops one can observe if the wire undergoes longitudinal vibration with the same load?	**8**	**CO4**
6	A plane transmission grating gives 3rd order diffraction maximum of He-Ne-laser (λ = 632.5 nm) at 30 degree on a screen placed 50 cm away from grating. Calculate grating element and separation between central spot and 3rd spot on the screen.	**8**	**CO3**

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