Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Waves & Optics Semester: II
Program: BSc Physics (H) **Time 03 hrs.**
Course Code: PHYS 1014 **Max. Marks: 100**
No. of Pages:2
Instructions: All the questions are compulsory. Q6 and Q11 have internal choices

SECTION A

S. No.		Marks	CO
Q 1	What is a wavefront? Discuss Huygens principle for wave optics.	**4**	**CO1**
Q2	How is diffraction phenomenon fundamentally different from the interference phenomenon? (Definitions not required.)	**4**	**CO1**
Q3	A plane wave, $X = 5\sin(2x - t)$ travels with a phase velocity, v_p = 2.5 m/s. Deduce the frequency of the given wave.	**4**	**CO2**
Q4	In a Newton's rings experiment the diameter of 10^{th} ring changes from 1.40 to 1.27 cm when a drop of liquid is introduced between the lens and the glass plate. Calculate the refractive index of the liquid.	**4**	**CO3**
Q5	What do you mean by a plucked string? What harmonics will be absent if the string is plucked from middle? (Do not derive but use appropriate diagram and conditions)	**4**	**CO2**

SECTION B

Q6	Write short note on any one of the following with suitable diagrams: (a) Fabry Perot interferometer (b) Michelson's interferometer	**10**	**CO1**
Q7	What is a zone plate? Give its theory and show that it has multiple foci.	**10**	**CO2**
Q8	Derive the expressions for reflection and transmission coefficients for a transverse wave at a boundary between two strings.	**10**	**CO2**
Q9	Discuss interference of light waves using a biprism. Show that for two positions of lens the virtual sources (separated by d) will be observed with the condition, $d = \sqrt{d1 d2}$ where, d1, d2 are magnifications for the respective positions.	**10**	**CO4**

SECTION-C

Q10	(a) In a diffraction phenomenon using double slit, calculate (i) the distance between the central maximum and the first minimum of the fringe envelope and (ii) the distance between any two consecutive double slit dark fringes. (b) Calculate the velocity of sound in (a) water and (b) steel. Given density of steel = $7800\,kg\,m^{-3}$, Young's modulus of steel = $20 \times 10^{10}\,N\,m^{-2}$ and bulk modulus of	**20**	**CO3**

	water = $0.20 \times 10^{10}\, N\, m^{-2}$		
Q11	Give the theory of superposition of N simple harmonic oscillations having a constant phase difference between. Use this theory to derive the expression of intensity for a diffraction grating. Also, derive the conditions for maxima and minima and draw the diffraction pattern. (Use suitable diagrams.) OR Give the theory of Newton's rings in reflected light using suitable diagrams. Explain how it can be used to determine (i) the wavelength of light, and (ii) the refractive index of unknown liquid.	**20**	
	END		