Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2024

Course: Waves & Optics **Semester : III**
Program: B.Sc Physics by Research **Time : 03 hrs**
Course Code: PHYS 2033 **Max. Marks: 100**

Instructions:

- All questions are compulsory (**Q.No. 9** and **Q.No. 11** has an internal choice)
- Scientific calculators can be used for calculations

SECTION A
(5Q x 4M = 20 Marks)

- All questions are compulsory, Each Question carries **4 Marks**
- Write very Short Answers/ Solve

Q. No.	Statement of question	Marks	CO
1	Distinguish between the progressive and stationary waves.	4	CO1
2	Show that the particle velocity is wave velocity times the slope of the displacement curve.	4	CO2
3	A travelling wave propagates according to the expression $y = 0.03\sin(3x - 2t)$ where y is the displacement at position x and time t. Taking the units to be in SI, determine the wavelength and frequency.	4	CO2
4	The ratio of intensity of the maxima and minima of interference fringes is $25:9$. Determine the ratio between the intensities of the two interfering beams.	4	CO1
5	Distinguish between interference and diffraction.	4	CO1

SECTION B
(4Q x 10M = 40 Marks)

- All questions are compulsory, **Q.No. 9** has an internal choice, Each Question carries **10 Marks**
- Write Short/ Brief notes/ Derive/ Solve

Q. No.	Statement of question	Marks	CO
6	What are standing waves? Standing waves are produced by the superposition of two waves $y_1 = 10\sin(3\pi t - 4x)$ and $y_2 = 10\sin(3\pi t + 4x)$. Find the amplitude of motion at $x = 18$. **(4+6)**	10	CO1
7	With a neat sketch, describe the formation of Newton's rings in reflected monochromatic light. Give the necessary mathematical formulation. **(10)**	10	CO2
8	**(a)** A diffraction grating with 5000 lines per cm is used at normal incidence. Calculate the dispersive power of the grating in the third order spectrum in the wavelength region 5000 Å. **(5)**	10	CO2

	(b) In Fraunhofer diffraction pattern of a double slit it is found that the second secondary maxima is missing. What is the ratio of the slit width to the slit separation? **(5)**		
9	**(a)** Show that the velocity of transverse waves along a stretched string is $v = \sqrt{\frac{T}{m}}$, where T is the tension applied to the string and m is linear density. **(10)** **(OR)** **(b)** Discuss the linear combination of two collinear simple harmonic waves of slightly different frequencies. Give the mathematical analysis to determine the frequency of beats. **(10)**	**10**	**CO3**

SECTION-C
(2Q x 20M = 40 Marks)

- All questions are compulsory, **Q.No. 11** has an internal choice, Each Question carries **20 Marks**
- Write long answer/ Derive/ Solve

Q. No	Statement of question	Marks	CO
10	**(a)** White light falls normally on a film of soapy water whose thickness is 5×10^{-5} cm and $\mu = 1.3$. Which wavelength in the visible region will be reflected most strongly in the first four wavelengths formed. **(10)** **(b)** Define the resolving power of a grating. Obtain an expression for the resolving power of an optical grating. **(10)**	**20**	**CO3**
11	Describe Fraunhofer diffraction at a single slit and deduce the positions of central maximum, principal minima and secondary maxima. Draw the representative graph of the intensity distribution. **(15+5)** **(OR)** Explain the construction and working of a zone plate. Show that the zone plate has multiple focii. Distinguish between convex lens and the zone plate **(15+5)**	**20**	**CO4**