Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

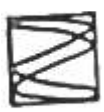
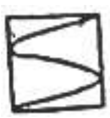
Online End Semester Examination, June 2021

Course: Waves & Optics	**Semester: II**
Program: B.Sc. (H) Physics	**Time 03 hrs.**
Course Code: PHYS 1014	**Max. Marks: 100**

SECTION A

1. Each Question will carry 5 Marks

2. Instruction: Write the statement / Select the correct answer(s)

S. No.		Marks	CO
Q1	What is a wavefront? State Huygens principle for wave optics.	**5**	**CO1**
Q2	Which of the following Lissajous figures correspond to frequency ratio 3:1 of two perpendicular simple harmonic motions? A.  B.  C.  D. 	**5**	**CO1**
Q3	Find the maximum value of resolving power of a grating 3 cm wide having 5000 lines per cm, if the wavelength of light used is 5890 Å. A. 40000 B. 45000 C. 4500 D. 5000	**5**	**CO3**
Q4	In Newton's ring experiment, the diameter of the 12th ring was found to be 0.504 cm and that of the 6th ring was 0.336 cm. If the radius of Plano convex lens is 100 cm, what will be the wavelength of light used? A. 5885 Å B. 5880 Å C. 5890 Å D.5850 Å	**5**	**CO3**

Q5	What do you mean by a plucked string? What harmonics will be absent if the string is plucked from middle?	**5**	**CO2**
Q6	In plane transmission grating, the angle of diffraction for second order maxima for wavelength 5 x 10 $^{-5}$ cm is 30^0. Calculate the number of lines in one inch of the grating surface. A. 7000 lines/cm B. 5400 lines/cm C. 12700 lines/cm D. 12000 lines/cm	**5**	**CO3**
SECTION B **1. Each question will carry 10 marks** **2. Instruction: Write short / brief notes**			
Q7	Write the short notes on the following: (a) The conditions for a sustained interference pattern (b) Coherent sources and how they are created	**10**	**CO1**
Q8	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, $d = \sqrt{d_1 d_2}$ where, d_1, d_2 are magnifications for the respective positions.	**10**	**CO1**
Q9	Deduce Kinetic Energy (T) of a vibrating string in the form $T = \frac{\mathrm{M}}{8} \sum_n \omega_n^2 C_n^2$ where, M = total mass of the string, ω_n and C_n are the frequency amplitude of n^{th} order vibrational mode, respectively.	**10**	**CO2**
Q10	Discuss Fresnel's half period zone with diagram. Show that the radius of m^{th} order zone, $\mathrm{r_m} \propto \sqrt{\mathrm{m}}$ where, m is natural number	**10**	**CO2**
Q11	(a) In Young's double slit experiment (sodium light, λ = 590 nm) one measures fringe width, β = 0.5 mm on a screen placed 25 mm away from the slits. Calculate slits separation d. (b) When the movable mirror in Michelson's interferometer is shifted by 0.003 cm, a shift of 100 fringes is observed. Calculate the working wavelength. Consider the experiment is performed in air. OR (a) Two open pipes of lengths 100 cm and 105 cm produce 5 beats in 6 s when each is sounding its fundamental note. Calculate the frequencies of the two notes. (b) Calculate the velocity of sound in (a) water and (b) steel. Given density of steel =7800 kgm^{-3}, Young's modulus of steel = $20 \times 10^{10} Nm^{-2}$ and bulk modulus of water = $0.20 \times 10^{10} Nm^{-2}$.	**10**	**CO3**
SECTION-C **1. Each Question carries 20 Marks.** **2. Instruction: Write long answers.**			
Q12	What do you understand by the characteristic impedance of a vibrating medium? Using appropriate analysis, find the expressions for reflection and transmission coefficients for a transverse wave at a boundary between two strings and for a longitudinal wave at a boundary between two rods.	**20**	**CO4**

	OR Tabulate the differences between Fresnel and Fraunhofer diffraction of light and using appropriate diagram, analyze the single slit Fraunhofer diffraction to find the conditions for maxima and minima. Also, plot the graphs for $y = \alpha$ and $y = \tan\alpha$ and show the positions of secondary maxima.		
	END		