D:- 08.02.23
Autonomy

GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2022-2023

PHYSICS - I

PH101

TIME ALLOTTED : 3 HOURS **FULL MARKS : 70**

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)

Answer any *ten* from the following, choosing the correct alternative of each question: 10×1=10

		Marks	CO No.
1. i.	The path difference between two interfering waves at a point on the screen is 81.5 times λ. What is the nature of the fringe ? a) Bright b) Dark c) White d) Coloured	1	CO1
ii.	In case of negative crystal, which statement is correct? a) Velocity of E-ray is larger than O-ray along the optical axis b) Velocity of O-ray is larger than E-ray along the optical axis c) Velocity of E-ray is larger than O-ray except along optical axis d) Velocity of O-ray is larger than E-ray except along optical axis	1	CO2
iii.	Active medium for Ruby laser is a) Aluminium b) Chromium c) Alumina d) Copper	1	CO2
iv.	Resolving power of grating is a) nN b) n/N c) N/n d) N^2n	1	CO3
v.	Atomic population in different energy states of a system in thermal equilibrium is governed by a) Bragg's law b) Boltzmann distribution law c) Malus's law d) Wien's law	1	CO2
vi.	Transverse characteristics of light waves are verified by the phenomenon of a) Diffraction b) Reflection c) Polarization d) Interference	1	CO2

vii The velocity with which energy is transported through a medium is — 1 — CO4
a) Phase velocity
b) Group velocity
c) Complex velocity
d) Imaginary velocity

viii KE of SHM is maximum at (a=amplitude) — 1 — CO2
a) X=a
b) X=0
c) X=a/2
d) None of these

ix The dimension of the Compton wavelength will be — 1 — CO3
a) [ML]
b) [L]
c) [LT]
d) [T]

x Two S.H.M.s of the same amplitude, period and phase act right angles to each other. The resultant vibration will be — 1 — CO3
a) Circular
b) Elliptical
c) Straight line
d) None of these

xi Decay of the vibrations caused by frictional resistance is known as — 1 — CO1
a) a)Rarefaction
b) Damping
c) Forced oscillation
d) None of the above

xii The quality factor of a series LCR is — 1 — CO3
a) $\sqrt{\frac{L}{C}}$
b) $\frac{1}{R}\sqrt{\frac{L}{C}}$
c) $\frac{1}{R}\sqrt{\frac{C}{L}}$
d) None of the above

GROUP – B
(Short Answer Type Questions)
(Answer any *three* of the following) **3×5 = 15**

		Marks	CO No.
2. a)	Why the center of the Newton's ring appear dark in reflected system?	2	CO3
b)	What are the basic conditions for producing sustained interference pattern?	3	CO3
3. a)	State & Explain Malus's law of polarization.	2	CO2
b)	Show that an ideal polarizer maximally can transmit 50 % of the polarized light.	3	CO2
4. a)	Find Compton wavelength for an electron	3	CO3
b)	Why unmodified line appears in Compton scattering?	2	CO2
5.	Find out the relativistic expression for de-broglie wavelength.	5	CO3

6. a)	What is amplitude resonance?		1	CO1
b)	Find amplitude at resonant frequency.		4	CO3

GROUP –C
(Long Answer Type Questions)

(Answer any *three* of the following) 3×15 = 45

		Marks	CO No.
7. a)	Derive an expression for intensity due to grating diffraction and hence find the intensity expression for double slit case.	7	CO3
b)	Show that the intensity due to 1st order secondary maximum for single slit diffraction is 4.5 % of the intensity due to principal maximum.	4	CO3
c)	What do you mean by missing order in case of Fraunhofer double-slit diffraction. Hence explain it with necessary diagram for b = 2e, where symbols have their usual meaning.	4	CO3
8. a)	Explain the working of Nicol as a polariser with the help of a neat diagram.	5	CO2
b)	Two crossed polarizers cannot transmit light. But light may be transmitted by inserting a third polarizer between them. Explain from Malus's law.	3	CO2
c)	What is Rayleigh Criterion of resolution? Explain.	3	CO2
d)	Calculate the least width that a grating must have to resolve two components of Sodium D-line in the third order, the grating having 800 lines/cm. The wavelengths of two lines of sodium are 5896 A° and 5890 A° respectively.	4	CO2
9. a)	What do you mean by resonance? Derive the condition for amplitude resonance.	5	CO2
b)	Write down the equation of damped vibration. Under what condition the motion becomes oscillatory? Derive the expression for displacement in case of oscillatory motion.	5	CO3
c)	What is sharpness of resonance? Explain how it is related to Q-factor in forced vibration.	5	CO2
10. a)	What is Heisenberg's Uncertainty Principle?	2	CO1
b)	Using Uncertainty principle, show that electrons cannot reside in the nucleus.	5	CO3
c)	Calculate the de Broglie wavelength of a particle of mass 10g moving with a speed of 300m/s. & explain why we cannot measure de Broglie wavelength for this classical particle.	3	CO4
d)	Establish a relationship between phase velocity and group velocity and hence prove that for non-dispersive medium group velocity is equal to phase velocity.	5	CO2
11. a)	Find the Packing fraction for BCC crystal	3	CO3
b)	What are Bravais lattices?	2	CO1
c)	Deduce the interplanar spacing of a simple cubic lattice of side 'a'.	5	CO3
d)	What do you mean by Miller indices?	2	CO1
e)	The distance between (d_{100}) plane in bcc structure is 0.335 nm. What is the size of the unit cell?	3	CO4