GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2022-2023
PHYSICS – I (Backlog)
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.	Intensity of principal maximum due to N-slit diffraction grating is proportional to	1	CO4

    a) N
    b) 1/N
    c) N^2
    d) $1/N^2$

ii.	Minimum no. of energy levels required for the operation of a laser system is	1	CO2

    a) 1
    b) 2
    c) 3
    d) 4

iii.	Two waves having intensities in the ratio of 9:1 produce interference. The ratio of maximum intensity to minimum intensity is equal to	1	CO3

    a) 4:1
    b) 4:9
    c) 10:8
    d) 12:4

iv.	If the wave function of a particle is ψ, the probability density is	1	CO2

    a) $|\psi|^2$
    b) $|\psi^2|$
    c) ψ^3
    d) ψ^4

v.	In optical fiber the physical principle works for the operation is	1	CO2

    a) Diffraction
    b) Polarization
    c) Interference
    d) Total Internal Reflection

vi.	Example of an extrinsic semi conductor is	1	CO2

    a) Silicon
    b) Germanium
    c) Gallium
    d) Diamond

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 Einstein's equation is used in   1   CO5
    a) Diffraction
    b) Interference
    c) Photoelectric effect
    d) Black-body effect

x Two S.H.M.s of the same amplitude, period and phase act right angles to   1   CO3
each other. The resultant vibration will be
    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 Name the experiment that proved de Broglie hypothesis.   1   CO1
    a) Davisson-Germer experiment
    b) Compton experiment
    c) de Broglie experiment
    d) Planck's experiment

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

		Marks	CO No.
2. a)	Derive N-slit diffraction intensity.	3	CO4
b)	Hence obtain primary maximum intensity due to such N-slits.	2	CO4
3. a)	Write down the basic differences between interference and diffraction.	2	CO3
b)	An oil-immersion microscope just resolves the rulings of a grating having 3900 lines/mm when light of wavelength 400 nm is employed. Find the numerical aperture of the lens.	3	CO4
4. a)	State the difference between amorphous and crystalline solid. What is Bravais lattice?	3	CO2
b)	If a light of wavelength 6000Å falls on a metal surface and photoelectrons with velocity 4×10^7 m/s, what is the threshold wavelength?	2	CO5

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)	What are the missing orders? Explain with the condition.	3	CO4
b)	What are the conditions for the operation of a laser?	3	CO1
c)	Discuss about the basic components of a laser system.	4	CO1
d)	Show that the ratio of spontaneous to stimulated emission in terms of Einstein's coefficients are proportional to the cube of frequency.	5	CO4
9. a)	State & Explain Bragg's law for crystal diffraction.	3	CO3
b)	Explain Miller indices in relation to crystalline solid. Hence find out the Miller indices of a plane which cuts intercepts of 2,3, and 4units along the three axes .	5	CO5
c)	State and explain Heisenberg's Uncertainty Principle. Explain the non-existence of electron in nucleus based on Heisenberg's Uncertainty Principle.	7	CO3
10. a)	Write down the equation of forced vibration and solve it.	3	CO4
b)	State the physical significance of the quality factor of a forced vibrator.	3	CO4
c)	Distinguish between amplitude resonance and velocity resonance.	3	CO1
d)	A voltage having root mean square value $V_{rms} = 100$ volts is applied to a series resonant circuit with resistance $R = 10$ ohm, inductance $L = 10$ mH and capacitance $C = 1\mu H$. Calculate the natural frequency and current at resonance in the circuit.	6	CO3
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