Total No. of Printed Pages: 03

SUBJECT CODE NO: - Y-2013
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. F.Y (Sem. I)
Examination March / April - 2023
Physics Paper-I Mechanics Properties of Matter and Sound

[Time: 1:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B 1) Attempt all questions.
2) Use of logarithm table and electronic pocket calculator is allowed.

Q1 a) Derive an expression for gravitational potential and gravitational filed due to a spherical shell at a point outside the shell. 10

b) Explain Cantilever? Obtain an expression for cantilever loaded at free end when weight of beam is effective. 10

OR

c) Define viscosity of a liquid? 10
Derive an expression for total energy liquid flow.

d) Derive an expression $E = E_m\, e^{-\propto t}$ by using Sabine's formula. 10

Q2 a) Write a short note on Newton's Law of gravitation. 05

b) The radius of earth $6.37 \times 10^8\ cm$ its mean density 6gm/cc and the gravitational constant $G = 6.66 \times 10^{-8}$ dynes cm^2/gm^2. Calculate the earth's surface potential. 05

c) Write a short note on law of hydrostatics pressure. 05

d) Calculate the excess of pressure between the inside and outside of a soap bubble of radius 0.01m. Surface tension of soap solution is $3.5 \times 10^{-1}\ N/M$ 05

OR

a) Write a short note on Modules of rigidity (η) 05

b) A brass bar 1cm square in 05
Cross-section is supported on two
Knife-edges 100cm apart.
A load of 2kg at the centre of the bar depression that point by 0.25cm. What are Young's modules of a brass?

c) Explain briefly application of Ultrasonic waves.

d) Calculate velocity of longitudinal wave in magnetostriction rod of length 0.4m. 05
At resonance the value of inductance is 2H and that of capacitor is 05
$0.02 \times 10^{-6} F$

Q3 Multiple choice questions. 10

1) The unit of gravitational potential is.
   a) J
   b) J/kg
   c) J.kg
   d) Kg

2) The gravitational field potential at a distance r from a solid sphere is x. The solid sphere is now replaced by an identical hollow sphere of the same mass. The gravitational field potential now changes from x to y. the ratio x/y is,
   a) Infinite
   b) 0
   c) 1
   d) -1

3) The gravitational potential at a point on the outer surface of the spherical shell of mass M and radius R is,
   a) $\frac{Gm}{R^2}$
   b) $\frac{-Gm}{R^2}$
   c) $\frac{Gm}{R}$
   d) $\frac{-Gm}{R}$

4) The bulk modules of a gas is $6 \times 10^3\ N/m^2$ the additional pressure needed to reduce volume of the gas by 10% is
   a) $300\ N/m^2$
   b) $400\ N/m^2$
   c) $1000\ N/m^2$
   d) $600\ N/m^2$

5) According to Hooke's law of elasticity, within elastic limits, if the stress is increased, the ratio of stress to strain.
   a) Increases
   b) Decreases
   c) Becomes zero
   d) Remains constant

6) The symbol Y,K and η represent the Young's modules, bulk modules and rigidity modules of the material of a body. If $\eta = 3K,$ then
   a) Y = 2.5K
   b) Y = 3.5K
   c) Y = 4.5K
   d) Y = 9K/5

7) Filter pump is used to generate
   a) Elasticity
   b) Force
   c) Vacuum
   d) Pressure

8) Viscosity of liquid is given by formula
   a) $\frac{\pi r^4}{8\,lJ}$
   b) $\frac{P\,\pi\,r^4}{8\,lJ}$
   c) $\frac{P\,\pi\,r}{4\,lJ}$
   d) $\frac{4P\,\pi}{l\,Jr^4}$

9) Technique used for detection of flaw in railway track
   a) X-rays
   b) R-rays
   c) Ultrasonic
   d) Ultraviolet

10) Reverberation in hall is due to
   a) Refraction of sound
   b) Reflection of sound
   c) Refraction of light
   d) Reflection of light

Total No. of Printed Pages: 3

SUBJECT CODE NO: - Y-2014
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. F.Y (Sem-I)
Examination March / April - 2023
Physics Paper-II Heat and Thermodynamics

[Time: 1:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B 1) Attempt all questions.
2) Use of logarithm table & electronic pocket calculator is allowed.

Q1 a) Derive the Fourier's differential equation by using. Rectilinear flow of heat along a metal bar. 10

b) Derive an expression for the viscosity (n) of a gas in terms of mean free path of its molecules. 10

OR

c) Describe Carnot's cycle and deduce the efficiency of an ideal heat engine. 10

d) prove that the thermodynamics relations. 10

i) $T.ds = CvdT + T(\frac{\partial P}{\partial T})_V dv$

ii) $T.ds = CvdT - T(\frac{\partial P}{\partial T})_P dp$

Q2 a) Write a short note on transference of Heat. 05

b) The opposite faces opposite face of a metal plate of 0.3cm thickness are at a difference of temperature of 100°c and the area of the plate is 200 sq. cm. Find the quantity of heat that will flow through the plate in one minute if (K=0.2 CGS units). 05

c) Explain the concept of reversible and irreversible process. 05

d) Calculate the work done when a gram molecule of a gas expands isothermally at 27°C to double its original volume. Given R=8.3 Joule deg^{-1} $mole^{-1}$ 05

OR

a) Give the reason for modification of a gas equation. 05

b) Calculate the mean free path of a gas molecule. Given that the radius of a gas molecule is 3A. U. and number of molecules is $1.8 \times 10^{25}\ per\ m^3$ 05

c) Explain second law of thermodynamics in terms of entropy. 05

d) Calculate the change in entropy when log of ice at 0°C is converted into water at same temperature (Latent heat of ice = 80 $^{cal}/_{g}$) 05

Q3 Multiple choice questions. 10

1. The dimension of thermal resistance is

   a) $M^{-1}L^{-2}T^{3}\theta^{1}$ b) $M^{1}L^{1}T^{-3}\theta^{-1}$

   c) $M^{1}L^{-2}T^{-3}\theta^{1}$ d) $M^{2}L^{2}T^{-3}\theta^{-2}$

2. In Ingen-Hauz experiment the thermal Conductivity 'k' and length 'l' of the rod up to which wax melts are related as.

   a) $\frac{k}{l} = constant$ b) $\frac{k}{l^2} = constant$

   c) $\frac{k^2}{l} = constant$ d) $kl = constant$

3. Vander Waal's equation is

   a) $\left(P + \frac{a}{v^2}\right)(v + b) = RT$ b) $(p - b)\left(V + \frac{a}{v^2}\right) = RT$

   c) $\left(P + \frac{v^2}{a}\right)(v - b) = RT$ d) $\left(P + \frac{a}{v^2}\right)(v - b) = RT$

4. The coefficient of viscosity is independent on

   a) Temperature b) pressure c) density d) mean free path

5. An ideal heat engine exhausting heat at 127°C is to have 27% efficiency. It must take heat at

   a) 127.9°C b) 137.9°C c) 247°C d) 327°C

6. The work done during an adiabatic process is

   a) $W = \frac{p_1 v_{1-} p_2 v_2}{v-1}$ b) $W = \frac{p_1 v_{1-} p_2 v_2}{1-v}$

   c) $W = \frac{nR(T_{1-} T_2)}{v-1}$ d) Both a and c

7. A gas expands by 0.25m^3 at constant pressure 10^5N/m^2. The work done by the gas is

   a) 250J b) 2500J c) 25000J d) 250000J

8. Which of the following represent a reversible process?

   a) $ds < 0$ b) $ds = 0$ c) $ds > 0$ d) $ds \geq 0$

9. The clausius clapeyron equation is

   a) $\frac{dP}{dT} = T.L(v_2 - V_1)$ b) $\frac{dP}{dT} = \frac{T}{L(v_2 - V_1)}$

   b) c) $\frac{dP}{dT} = \frac{L}{T(v_1 - V_2)}$ d) $\frac{dP}{dT} = \frac{L}{T(v_2 - V_1)}$

10. Entropy is maximum in which state

    a) Solid b) Liquid c) gas d) All of these

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SUBJECT CODE NO: - YY-2339
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. F.Y (Sem-II)
Examination March / April - 2023
Physics Paper-IV
Optics Paper

[Time: 1:30 Hours] **[Max. Marks: 40]**

Please check whether you have got the right question paper.

N. B
i) All questions are compulsory.
ii) All questions carry equal marks
iii) Draw neat diagrams and give labels wherever necessary.
iv) Figures to the right indicate full marks.

Q1 Obtain an equivalent focal length of the coaxial lens system of two lenses separated by a certain distance and obtain the positions of principal planes. 10

OR

Explain in brief 10

i) Ramsden's eyepiece.
ii) Focal length of the field lens in Huygens eyepiece is 3 cm. find the focal length of the eye lens, the distance between two lenses, and the equivalent focal length of the eyepiece.

Q2 Describe the principle, construction, and working of Michelson's Interferometer. 10

OR

Explain in brief 10

i) Brewster's law.
ii) Find the Specific rotation of sugar solution if 20% sugar solution is taken in the sample tube of length 20 cm and optical rotation is found to be 23.5 degrees.

Q3 Write a short note on (any two) 10

i) Principal focus points
ii) Huygens Eyepiece
iii) Resolving power of Grating
iv) Nicol Prism.

Q4 Multiple Choice Questions 10

1. In geometrical optics a ray of light is shown by
   (a) A straight line (b) A directed straight line (c) A sine wave (d) triangular wave
2. There are _____ Cardinal points belonging to an optical system
   (a) 2 (b) 4 (c) 6 (d) 8
3. In Huygens eyepiece focal lengths of two lenses are 3f and f, the distance between them is_____.
   (a) f (b) 2f (c) 3/4 f (d) 2/3 f
4. The bending of the beam of light around the corners of an obstacle is called as
   (a) diffraction (b) interference (c) polarization (d) dispersion
5. In the Newtons rings the fringe width_____ with the increasing number of orders.
   (a) decreases (b) increases (c) remains unchanged (d) none of these
6. Grating element for plane transmission grating is _____.
   (a) a (b) b (c) a-b (d) a + b
7. In the Nicol prism two sections of calcite crystal are cemented together by _____.
   (a) Canada balsam (b) Orient cement (c) Quartz material (d) Birla Gold.
8. Two lenses of focal lengths f1 and f2 are separated by distance d, if f is the equivalent focal length of combination, then the distance of the first principal point from the first lens is3
   (a) $\frac{fd}{f1}$ (b) $-\frac{fd}{f1}$ (c) $\frac{fd}{f2}$ (d) $-\frac{fd}{f2}$
9. The plane of polarization is that plane in which
   (a) Vibration occurs (b) Vibrations do not occur
   (c) Circular vibrations occur (d) elliptical vibrations occur
10. The radius of the 20th Newton's ring if the incident light is having a wavelength of 600 nm, the radius of curvature of the lens is 10.08 m
    (a) 0.011m (b) 11m (c) 0.011 cm (d) 11 cm

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SUBJECT CODE NO: - Y-2025
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. F.Y (Sem-II)
Examination March / April - 2023
Physics Paper- IV Geometrical & Physical Optics

[Time: 1:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B 1) Attempt all questions.
2) Use of logarithmic table and Electronic Pocket Calculator is allowed..

Q1	a.	Explain with neat diagram the construction and theory of Ramsden's eyepiece.	10
	b.	Give the theory of Newton's experiment for measuring the wavelength of rings Sodium light	10
		OR	
	c.	Derive an Power of expression for resolving grating	10
	d.	Define polarization. Describe construction and working of Nicol Prism	10
Q2	a.	Write a note on principal point and Principal plane of co-axial lenses System	05
	b.	The focal length of the more Convergent lens of Huygen's eyepiece is 0.5 cm. Calculate the focal length of eyepiece	05
	c.	Write a note on diffraction at a thin wire	05
	d.	Find the minimum lines that diffraction grating should have to resolve in the first order, the doublet with difference in wavelength of $1.8A^0$ wavelength 6563 A°	05
		OR	
	a.	Write a note on wedge shaped film.	05
	b.	In Newton's rings experiment the diameter of 15^{th} ring was found to be 0.59cm. and that of the string was 0.336cm. If the radius of the Plano convex lens is 100 cm. Calculate the wavelength of light used.	05
	c.	Explain Malu's Law.	05
	d.	Determine the specific rotation of the given sample of sugar Solution using biquartz polarimeter, if the plane of polarization is turned through 20°. The length of the tube containing 50% of Sugar solution in 1 decimetre	05

Q3 Multiple Choice question. 10

1. Huygen's eyepiece consist of _____
   a. two plano coxvex lenses of focal lengths 3f and f seperated by 2f.
   b. two plano convex lenses of focal lengths 3f and f seperated by $\frac{2}{3}$f
   c. two plano convex lenses of focal lengths 3f and f seperated by 2f
   d. two plano convex lenges of focal lengths are 3f and f separated by $^3/_2\ f$

2. In Ramsden's eyepiece if the focal length of eyelens is 12 cm then distance between two lenses is _____
   a. 8 cm b. 10 cm c. 12 cm d. 14 cm

3. In Newton's rings experiment with the order of rings Fringe width ____
   a. Increases b. decreases c. remain constant d. none of these

4. In Michelson's interferometer if two mirrors are mutually perpendicular the the types of fringe's observed are ____
   a. Circular b. Straight c. White light d. both a and b

5. The number of lines per unit length over the grating surface is increased, then the resolving power of grating will _____
   a. Decrease b. increase c. remains unchanged d. none of above

6. If there are $5x10^4$ number of lines on the grating surface, the resolving power of grating for the first order is _____
   a. $2 \times 10^{-5}m$ b. $2 \times 10^{5}m$ c. $5 \times 10^{5}m$ d. $5 \times 10^{4}m$

7. Polarization indicated light is _____
   a. Longitudinal wave
   b. Transverse wave
   c. Quantum nature
   d. Both a and b

8. A calcite crystal is a __
   a. Uniaxial crystal
   b. Biaxial crystal
   c. Opaque crystal
   d. Triaxial crystal

9. In case of extra ordinary ray its refractive index varies with a _____
   a. Incident angle b. Ordinary angle c. reflection angle d. normal

10. In Huygen's eyepiece focal length of lenses are 3f and f and the distance between them is _
    a. f b. 2f c. 3f d. $\frac{2}{3}$ f

Total No. of Printed Pages: 2

SUBJECT CODE NO: - YY-2340
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. F.Y (Sem. II)
Examination March / April - 2023
Physics Paper-V Electricity and Magnetism

[Time: 1:30 Hours] **[Max. Marks: 40]**

Please check whether you have got the right question paper.

N. B
1. All questions are compulsory.
2. All questions carry equal marks.
3. Draw neat diagrams and give labelled wherever necessary.
4. Figures to the right indicate full marks.

Q1 a) Define scalar triple product and show that it remains unchanged under cyclic change of vector $(\vec{A}\,\vec{B}\,\vec{C}) = (\vec{B}\,\vec{C}\,\vec{A}) = (\vec{C}\,\vec{A}\,\vec{B})$ 10

OR

Explain in brief.

a) Potential due to a point charge 10

b) Calculate the electric potential due to the dipole of the dipole moment $4.5*10^{-10}$ C/m at a distance 1m from its center and on its axis

Q2 a) Derive an expression for Gauss law dielectric. 10

OR

Explain in brief.

a) Magnetic induction due to straight current carrying conductor. 10

b) Calculate magnetic induction at a distance of 1.75 m from the axis of a long straight wire carrying a current of 140 A.

Q3 **Write a short note on (any two)** 10

a) Geometrical interpretation of $\nabla\phi$
b) Electric field
c) Dielectric
d) Ampere's circuital law.

Q4 **Multiple Choice Questions.** 10

1. Divergence of a vector field is the net outward flux of a vector per unit --------
   a) Surface area b) volume c) length d) none of these

2. $\nabla.(AB)$ is equal to ----------
   a) $(\nabla.A)(\nabla.B)$ b) $\nabla.A + \nabla.B$ c) $\nabla^2.AB$ d) $B\,\nabla.A + A\nabla.B$

3. Electric intensity is a ----------
   a) Scalar b) Vector c) Tensor d) Number

4. The potential at a point due to a charge is 9 V. if the distance is increased three times the potential at that point will be ----------
   a) 27 V b) 3V c) 12 V d) 18V

5. Dipoles are created when the dielectric is placed in ----------
   a) Magnetic Field b) Electric field c) Vacuum d) Inert environment

6. Dielectric constant for metal is ----------
   a) Zero b) Infinite c) One d) Ten

7. The unit of magnetic induction is ----------
   a) Wb.m b) Tesla c) A/m^2 d) Wb/m^2

8. The magnetic induction due to a long straight conductor carrying a current at a distance X is B. if distance X is double then magnetic induction becomes ------.
   a) Double b) Half c) Zero d) Constant

9. If proton moves with velocity 3.1 x 10^7 m/s, perpendicular to magnetic induction 1.5 Wb/m^2, force of proton is --------
   a) $74 \times 10^{-12}\ N$ b) $37 \times 10^{-12}\ N$ c) $7.4 \times 10^{-12}\ N$ d) 3.7×10^{-12} N

10. The Gaussian surface for a point charge will be, ---------
    a) Cube b) Cylinder c) Sphere d) Cuboid

Total No. of Printed Pages: 03

SUBJECT CODE NO: - Y-2026
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. F.Y (Sem-II)
Examination March / April - 2023
Physics Paper-V Electricity & Magnetism

[Time: 1:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B 1) Attempt all questions.
2) Use of Logarithmic table and electronic pocket calculator is allowed.

Q1 a. Define vector triple product. Prove that triple product of three vectors is $a \times (b \times c) = b(a.c) - c(a.b)$ 10

b. State and prove Gauss's Law in electro statics. 10

OR

a. What is magnetic flux? Derive an expression for magnetic induction on the axis of solenoid. 10

b. Derive the expression for growth of current in LR circuit. 10

Q2 a. Define the divergence of vector and give its physical interpretation. 05

b. Find the directional derivatives of $\phi(x, y, z) = 3x^2y + 2x\,z^2 + 4yz^2$ at the point (1, 2, 2) in the direction $i - 2j + 3k$ 05

c. Write down statements of Ampere's Law and Biot-Savarts Law. 05

d. The magnitude of field vector H at a radius of 1 m from long conductor is 2 A/m find current in wire. 05

OR

a. Explain the term flux of electrical field. 05

b. Calculate the force of attraction between two charges. Of 5 μc and 6 μc separated by 1.5 m ($\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9\ S.I.Units$) 05

c. Write a short note on RC circuit. 05

d. If the battery of emf 100 V is connected in series with inductance of 10 mH a capacitor of 0.05μF and resistance of 100 Ω find Logarithmic decrement. 05

Q3 Multiple Choice Questions 10

1. The line integral of magnetic induction over a closed loop is permeability times the current through conductor, this Law is called.
   a. Gauss Law b. Faraday Law c. Ampere Law d. Biot-Savarts Law

2. The S. I unit of magnetic field is ____
   a. N/m^2 b. Wb / m^2 c. Tesla d. both b and c

3. If $\vec{A} . \vec{B} = \frac{AB}{\sqrt{2}}$ the angle between $\vec{A}$ *and* $\vec{B}$ is _____
   a. 30^0 b. 45^0 c. 60^0 d. 0

4. $\nabla.(AB)$ is equal to
   a. $(\nabla. A)(\nabla. B)$ b. $\nabla A + \nabla B$ c. $\nabla^2 B$ d. $B\nabla A + A\nabla B$

5. Dielectric constant K of Material is _____
   a. $\frac{C}{C_o}$ b. $\frac{\varepsilon}{\varepsilon_0}$ c. $\frac{C}{nC_0}$ d. both a and b

6. The equation of decay of current in LR circuit for R=100Ω and L=1H is ___
   a. $I = I_o e^{-R/L^t}$
   b. $I = I_o e^{-10t}$
   c. $I = I_o\, e^{-\frac{1}{100}^t}$
   d. $I = \frac{E}{R}\,(1 - e)^{-10t}$

7. The time constant of RC circuit is given by ___
   a. R/C b. $\frac{1}{RC}$ c. RC d. C/R

8. The electric field at a point charge varies with distance r as _____
   a. r^{-2} b. r^2 c. r^{-1} d. r

9. In LCR circuit for critically over damped condition

a. $\frac{R^2}{4L^2} = \frac{1}{LC}$ b. $\frac{R^2}{4L^2} > \frac{1}{LC}$ c. $\frac{R^2}{4L^2} < \frac{1}{LC}$ d. $\frac{R^2}{4L^2} = \frac{1}{C}$

10. If $\vec{P} = x\vec{\imath} + y\vec{\jmath} + \vec{k}$ is position vector then div $\vec{p}$ = ?

a. 6 b. 12 c. 9 d. 3

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SUBJECT CODE NO: - Y-2021
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. S.Y (Sem-III)
Examination March / April - 2023
Physics -VII Mathematical Statistical Physics and Relativity

[Time: 1:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B 1) Attempt all questions
2) Use of logarithmic table & electronic Pocket calculator is allowed.

Q1	a)	What is Partial differentiation? Discuss its geometrical interpretation.	10
	b)	Evaluate constants α and β using Maxwell - Boltzmann statistics.	10
		OR	
	a)	Deduce plank's black body radiation formula	10
	b)	Derive the mass-energy equivalence relation of Einstein.	10
Q2	a)	Write a note on total differentiation	5
	b)	We throw a die twice and obtain two numbers. What is the probability that these numbers are 6 & 4 precisely in that order?	5
	c)	Three particles are to be distributed in four energy levels a, b, c and d. write down all the possible ways of this distribution when particles are classical particles, Bosons, fermions.	5
	d)	Write a short note on length contraction.	5
		OR	
	a)	If $F = e^{-xy}, x = rcos\theta$ & $y = rsin\theta$ Find $\frac{\partial F}{\partial r}$ by chain rule.	5
	b)	Write a short note on permutation and combinations.	5
	c)	What is difference between classical and quantum statistics.	5
	d)	The rest energy of proton is 930 MeV. Calculate the relativistic Kinetic energy of a proton moving with a speed of 0-5c.	5

Q3 Multiple choice questions 10

1) The order of given differential equation $\frac{dy}{dx} + 2y = 0$ is

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

2) The quantity df = Fxdx + Fydy is called as

   a) An exact differential off b) Implicit function of F

   c) Explicit function of F d) Total differential of F

3) Statistical methods give greater accuracy when number of observations is

   a) Very small b) very large

   c) Neither very small or very large d) None of these

4) Five particles are distributed in two phase cells. Then number of macrostates is

   a) 6 b) 10 c) 32 d) 5/2

5) Bosons obey Pauli's exclusion principle

   a) True b) False c) Can't say d) Sometimes true or sometimes false

6) The spin of Photon is

   a) $\frac{1}{2}h$ b) $\frac{3}{2}h$ c) zero d) ħ

7) The formation of groups is called as

   a) Permutation b) combination c) Probability d) Frequency

8) The length contraction becomes appreciable only when

   a) V= C b V ≈ c c) V≠ c d) V > c

9) A particular task requires 3.46J energy. Using $E=mc^2$, how much Mass is needed to accomplish this task?

   a) 3.84 $X10^{-17}$ kg b) 3.46 x 10^{-16} kg

   c) 3.11 x 10^{17} kg d) 1.15 x 10^{-8} kg

10) According to Galilean transformation t' and t is

   a) Equal b) Not equal c) Approximately equal d) None of these

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SUBJECT CODE NO: - Y-2022
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. S.Y (Sem-III)
Examination March / April - 2023
Physics -VIII Modern and Nuclear Physics

[Time: 1:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B 1) Attempt all questions.
2) Use of logarithmic table and electronic Pocket calculator is allowed.

Q1 a) Explain Lenard's method to determine elm of photoelectrons. 10

b) Explain in detail Bragg's X-ray Spectrometer. 10

OR

a) Explain in detail binding energy of the nucleus. 10

b) Write the construction and operation of ionisation chamber. 10

Q2 a) Explain in short types of photocell. 05

b) Using Bragg's spectrometer the glancing angle of first order spectrum is 6^0. Find the wavelength of X-ray if inter-planer distance is 2.8×10^{-10}m. 05

c) Explain shell model of nucleus. 05

d) In a cyclotron, the frequency of an electron orbit is 7.6 MHz. Calculate the value of the magnetic induction applied. 05

OR

a) What will be the maximum velocity of photoelectrons if anode potential is 1KV. 05

b) Write a short note on X-ray Spectra. 05

c) Masses of the following isotopes are given. Calculate the BE of a neutron in the $_3Li^7$ nucleus. 05

Given $_3Li^7$ = 7.016004 amu

$3Li^6$ 6.015125 amu

And on^1 1.008665 amu

d) Write short note on Betatron 05

Q3 Multiple choice questions 10

1) The momentum of a photon is given by _____

   a) h/λ b) ħk c) $h\,\nu/c$ d) All of the above

2) The photoelectric effect proves that light consists of ...

   a) Photons b) Electrons

   c) Electromagnetic wave d) Mechanical wave

3) Which of the following is/are photosensitive material (s) ?

   a) Wood, Paper b) plastic, Wax

   c) Glass, Water d) Alkali metals

4) What is the Source of X-ray Photons in the tube?

   a) Cathode b) Rotor c) Filament d) Anode

5) The most intense in x-ray Spectral line is –

   a) $k\alpha$ b) $k\beta$ c) $L\alpha$ d) None of these

6) Unit of X-ray intensity is ____

   a) Coulomb b) Candela c) Roentgen d) Lux

7) The process by which a heavy nucleus is splitted into two light nuclei is Known as _____

   a) Nuclear splitting b) Nuclear fission

   c) Nuclear fusion d) chain reaction

8) The liquid drop model was proposed by the scientist

   a) Coulomb b) Yukawa c) Bohr d) Faraday

9) Nucleons are held together by.....

a) Magnetic force b) Electrostatic force

c) Nuclear force d) Gravitational force

10) A cyclotron can accelerate _____

a) β particles b) α particles

c) High-velocity X-rays d) None of these

Total No. of Printed Pages: 2

SUBJECT CODE NO: - Y-2033
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. S.Y (Sem.-IV)
Examination March / April - 2023
Physics Paper-XI (General Electronics)

[Time: 1.30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B 1) Attempt all questions.
2) Use of algorithmic table and calculator is allowed.

Q1 a) What is field effect transistor? Explain the construction and drain characteristics of P- channel JFET. 10

b) With neat circuit diagram explain the working of an RC coupled amplified with special reference to frequency response. 10

OR

a) With neat circuit diagram, explain the working of Bistable multivibrator & explain how it works as a frequency divider. 10

b) What is amplitude modulation? Draw the wave form of Am and discuss the side bands produced in it . 10

Q2 a) What is Zener diode? Explain avalanche and Zener break down. 05

b) Find I_B And $\beta_{d.c.}$ for a transistor if emitter current is 9 MA and collector current is 8.85 MA. 05

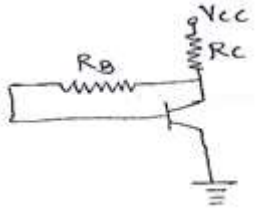
c) What is oscillator? Explain the condition for oscillations. 05

d) Calculate the Frequency of Hartley oscillator if $L_1 = L_2 = 20$ MH and C= 0.008 μF. 05

OR

a) What is OP- AMP? Explain the characteristics of an ideal OP- Amp. 05

b) It is desired to set the operating point at 2V, 1MA by biasing a silicon transistor with feedback resistance R_B . If β=100, find the value of R_B . 05



c) Discuss advantages of frequency modulation. 05

d) An audio signal of 2KHz is used to modulate a carrier of 600 KHz. Determine 05

i. Side band frequencies
ii. Band width required.

Q3 Multiple choice question. 10

1. Operating point mean _____ .
   a) Zero signal I_E and V_{CE}
   b) Zero signal I_E and V_{BE}
   c) Zero signal I_C and V_{CE}
   d) None of these.

2. Common collector arrangement of transistor is generally uses for ____.
   a) Gain matching b) Impedance matching
   c) Capacitance matching d) None of these.

3. If the Pn junction is heavily doped, breakdown voltage will _____.
   a) Increase b) Decrease
   c) Remains constant d) None of these.

4. The collector leakage current is strongly depends on _____ .
   a) Voltage b) Current c) Temperature d) Temperature

5. An inverting op – Amp has input resistance 200 kΩ , feedback resistance of 2mΩ, then gain A is___
   a) -15 b) -10 c) 6 d) 8

6. The band width is obtain at range of frequency over which the gain is equal to greater than _____ of the maximum gain.
   a) 70.7% b) 60.7% c) 75.5 % d) None of these

7. In phase shift oscillator, the frequency determining elements are _____.
   a) R and L b) L and C c) R and C d) None of these

8. A stable multivibrator circuit can be used as _____ .
   a) Squaring circuit
   b) Comparator circuit
   c) Voltage to frequency converter
   d) Frequency to voltage converter

9. Noise problem occurs in _____modulation.
   a) Frequency b) Amplitude
   c) Phase d) None of these.

10. In frequency modulation, the amplitude of the modulating signals determines _____.
    a) Amplitude of frequency shift
    b) Distance of broad cast
    c) Rate of frequency deviation
    d) Tonal balance of transmission .

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SUBJECT CODE NO: - Y-2034
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. S.Y (Sem. IV)
Examination March / April - 2023
Physics Paper- XII Solid State Physics

[Time: 1.30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B 1) All questions are compulsory.
2) Use of logarithmic table and electronic pocket calculator is allowed.

Q1	a)	Define and explain primitive and non primitive cell.	10
	b)	Given the difference between ionic and covalent bonding in solids.	10
		OR	
	a)	Explain Dulong's and Petit's law about lattice heat capacity and compare result with experimental result / Observation	10
	b)	Obtain an expression for electrical conductivity of metals.	10
Q2	a)	Write a short notes on" Wigner Sietz primitive cell	5
	b)	Lattice constant of cubic lattice is "a". Calculate spacing between (2 11) plane.	5
	c)	Give limitation of Debye theory of lattice heat capacity.	
	d)	The Einstein's temperature of carbon (diamond- Structure) is 2000k, calculate	5
		Height lattice frequency involved in a Debye theory. Where $K_B = 1.38*10^{-23}$ J/K, $h = 6.63*10^{-34}$Js'.	5
		OR	
	a)	Give characteristics of ionic bonds	5
	b)	Calculate bond length "ro" for stable configuration is equal of two atoms which having m=9, n=2	5
	c)	Write a short note on Transport properties.	5
	d)	Calculate the Widemann Frantz ratio at 300°k given that $K_B = 1.38*10^{-23}$J/K .	5

Q3 Attempt all questions 10

1. The collection of points in three dimension is known as

   a) Space lattice b) Unit cell c) Basis d) Crystal

2. Total number of distinct crystal system is _____.

   a) 6 b) 14 c) 2 d) 7

3. Shearing of valence election is a type of _____ bonding.

   a) Ionic b) Hydrogen c) Co- valent d) Vander-Wall

4. Hydrogen bond is formed in

   a) Alcohol b) Sodium chloride

   c) Chlorine Gas d) Silver nitrate.

5. According to which theorem vibrational energy is distributed equally along each dimension or degree of freedom.

   a) Einstein's theorem b) Equipartition theorem

   c) Dulong - Petit's theorem d) Debye- theorem

6. Quantum of elastic vibration is

   a) Photon b) Phonon c) Graviton d) meson

7. Fermi level is define as

   a) Lowest filled lead at 0^0 k

   b) Longest filled level at 0^0 k

   c) Lowest filled level 300^0 k

   d) Highest filled level at 300^0 k

8. The Weidmann – Franze law is represented by _____.

   a) k/6 α T b) K/6 α 1/T c) 6/k α T d) None of these

9. The Bravais of Nacl is

   a) S.C b) B.C.C c) F.C.C d) None of these

10. Cesium chloride is which type crystal

    a) Ionic crystal b) Covalent crystal c) Molecular crystal d) None of these

Total No. of Printed Pages: 03

SUBJECT CODE NO: - Y-2017
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. T.Y (Sem-V)
Examination March / April - 2023
Physics Paper-XV (Classical & Quantum Mechanics)

[Time: 1:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B 1) All questions are compulsory.
2) Question first and second 20 marks and question third 10 marks.

Given Data:

$K = 1.38 \times 10^{-23}\ J/K\ ; h = 6.63 \times 10^{-34}\ J.S$

$me = 9.1\ \times 10^{-31}\ Kg\ ; c = 3 \times 10^{8}\ m/s$

$1\ ev = 1.6\ \times 10^{-19}\ J\ ;\ \mu_0 = 4\pi\ \times 10^{-7}\ wb/Amp$

Q1 a) State and prove D' Alembert principle. 10

b) Obtain an expression of Plank's radiation law. Deduce Rayleigh's law from Plank's law. 10

OR

a) State and explain Heisenberg's Uncertainty Principle 10

b) Discuss the problem of particle in one dimensional box and prove that energy of particle is quantized 10

Q2 a) Explain the principle of virtual work. 05

b) Write a note on holonomic and non holonomic constraints 05

c) Calculate the wave length associated with a thermal electron of energy 2.5ev. 05

d) Explain the electron can not exist inside the nucleus. 05

OR

a) Show that linear momentum of photon in term of wave vector $\vec{k}$, $P = H\left|\vec{K}\right|$ 05

b) Calculate threshold frequency for tungsten surface whose work function is 4.5 ev. 05

c) Write a note on expectation values. 05

d) Calculate the first energy level of an electron in a box of $1°A$ wide 05

Q3 Multiple choice questions. 10

1) The constraints involved when a particle is restricted to move along a curve of surface are _____
   a) Holonomic
   b) Non holonomic
   c) Both a and b
   d) None of these

2) At woods machine is an example of _____ system.
   a) Linear
   b) Angular
   c) Conservative
   d) None of these

3) The spectrum of black body radiation is _____
   a) Line
   b) Band
   c) Continuous
   d) Absorption

4) Which of the following phenomenon supports the quantum nature of light _____
   a) Interference
   b) Diffraction
   c) Polarisation
   d) Compton effect

5) De-Broglies wavelength is _____
   a) $\lambda = {}^{h}/_{mv}$
   b) $h/\sqrt{2mkT}$
   c) $\lambda = h/\sqrt{2mE}$
   d) All of these

6) Devission and Germar experiment is related to _____
   a) Interference
   b) Polarization
   c) Diffraction
   d) All of these

7) Operator from the time dependent Schrodinger equation is _____
   a) $H\psi = 1$
   b) $H\psi = A$
   c) HA = AH
   d) $H\psi = E\psi$

8) The wave function must be _____
   a) Single valued
   b) Continuous
   c) Finite
   d) All of these

9) Which relation is correct _____
   a) $V = n\lambda$
   b) $K = {}^{2\pi}/_{\lambda}$
   c) $Vg = \frac{dw}{dk}$
   d) $All\ of\ these$

10) Probability density is _____
   a) $P = |\psi|^2$
   b) $P = \psi$
   c) $P = {}^{\psi}/_{2}$
   d) $P = 5\psi$

Total No. of Printed Pages: 2

SUBJECT CODE NO: - Y-2018
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. T.Y (Sem-V)
Examination March / April - 2023
Physics Paper- XVI (Electrodynamics)

[Time: 1:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B 1) All questions are compulsory.
2) Use of logarithmic table and electronic pocket calculator is allowed.

Q1 a) State Gauss law and derive the equation for the electric field intensity due to uniformly charged cylinder. 10

b) Derive two Maxwell's equation 10
$div\ D = \varrho\ and\ div\ B = 0$

OR

a) State the characteristics of electromagnetic wave. 10

b) Derive the boundary condition for H i.e. the tangential component is continuous across the surface separating two dielectrics. 10

Q2 a) Define divergence of E and curl of E. 05

b) State uniqueness theory. 05

c) Prove that electromagnetic wave is plane polarized. 05

d) State Poynting's theory. 05

OR

a) Define self-induction and mutual induction. 05

b) The current in the coil flows at the rate of 10 A/sec and e.m.f. induced is 1.5V. Calculate the self-inductance of the coil. 05

c) State the kinetic and dynamic properties of reflection and retraction of Em wave 05

d) The refractive indices of two medium are 1.5 and 1.55 respectively of incident and transmitted medium. If the angle of incidence is 30^0 , find the angle of transmission. 05

Q3 choose the correct answer 10

1) The EM wave obeys _____ law in case of refraction.
a) Poynting law b) Avogadro's law
c) Snell's law d) Faraday's law

2) The electric field intensity due to uniformly charged sphere at an internal point is proportional to _____
   a) Area of sphere b) Circumference of sphere
   c) Volume of sphere d) distance (r) of the point from the centre.
3) Maxwell's first equation is derived from ____
   a) Gauss theory in electrostatic
   b) Gauss theory in magnetostatics
   c) Faraday's law
   d) Lenz law
4) _____ is the equation of continuity.
   a) $curl\ H = J + \frac{\partial D}{\partial t}$ b) $curl\ B = J + \frac{\delta D}{\delta t}$
   c) $curl\ E = J + \frac{\partial D}{\partial t}$ d) $curl\ m = J + \frac{\partial D}{\partial t}$
5) Electromagnetic waves are _____
   a) Longitudinal wave b) Transverse wave
   c) sinusoidal wave d) square wave
6) _____ property of an electromagnetic wave depends on the medium in which it is travelling.
   a) Wavelength b) Time period c) Frequency d) Velocity
7) In Maxwell's fourth equation, the term $\frac{\delta D}{\delta t}$ is called as _____
   a) displacement current density b) current density
   c) displacement current d) displacement density
8) Electromagnetic waves are produced where as _____
   a) Electric charges are retarded
   b) Electric charges are accelerated
   c) Magnetic charges are retarded
   d) Magnetic charges are accelerated
9) EM wave travel in vaccum with a velocity _____
   a) 3×10^8 m/s b) velocity of light
   c) both a and b d) 331 m/s
10) The equation $\nabla^2 U = 0$ is known as _____
   a) Laplace equation b) Poisson's equation
   c) Gauss law d) Differential form of Gauss law

Total No. of Printed Pages: 03

SUBJECT CODE NO: - Y-2029

FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. T.Y (Sem-VI)

Examination March / April - 2023

Physics Paper-XIX (Atomic, Molecular Physics & Laser)

[Time: 1:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B
1. Attempt all questions.
2. Use of logarithmic table is allowed.
3. All questions carry equal marks.

Q1 a) Explain Thomson's atom model and give its limitations. 10

b) What is stark effect? Explain its experimental study with results. 10

OR

a) Give the theory of origin of vibration - rotation spectrum of a molecule 10

b) What is LASER? Explain the construction and working of He - Ne laser. 10

Q2 a) What are the drawbacks of Rutherford atom model. 05

b) Give any two applications of Raman effect. 05

c) Calculate the energy of electron in first Bohr's orbit. 05

Given: $e = 1.6\,x\,10^{-19}\,C$

$m = 9.1\,x\,10^{-31}\,Kg$

$h = 6.6 \times 10^{-34}\,JS$

$E_o = 8.85\,x\,10^{-12}\,c^2/Nm^2$

d) Find the reduced mass of hydrogen chloride molecule. 05

Given:

The mass of ^{35}cl $= 5.81 \times 10^{-26}$ $The\ mass\ of\ 'H = 1.67 \times 10^{-27}$ kg

OR

a) Write a short note on j-j coupling scheme. 05

b) Write a note on population inversion? 05

c) Calculate the angular momentum of 'd' electron. 05

$(Given, h = 6 \cdot 63 \times 10^{-34}\ JS)$

d) In CO2 Laser, the energy difference between the two LASER level is 0.1 eV. 05
Calculate the wavelength and frequency of the radiation.

Given: $h = 6 \cdot 63 \times 10^{-34}\ JS\ C = 3 \times 10^{8}\ m/s$

Q3 Choose the correct answer. 10

1. According to Bohrs theory of H-atom, the electron revolving in those circular orbit which have angular momentum is an integral multiple of,

   a) ħ b) $\frac{\hbar}{2\pi}$ c) $\frac{2\pi}{\hbar}$ d) $\frac{1}{\hbar}$

2. The energy of electron revolving in ground state is,....

   a) -13.6 eV b) 13.6 eV c) -1.36 eV d) 136 eV

3. Which of the following correct relation for j.j coupling.

   a) j=l+s b) j=l×s c) j=l/s d) j=l-s

4. The stark effect is..... analogy of the Zeeman effect.

   a) magnetic b) electrical c) optical d) magneto-optical

5. According to Rayleigh law of scattering, the intensity of light is inversely proportional to_____

   a) λ b) λ^2 c) λ^3 d) λ^4

6. Raman lines are_____

   a) Strongly polarised b) strongly unpolarised

   c) weakly polarised d) weakly unpolarised

7. Active centres in a ruby laser are_____

   a) AI^{3+}ions b) cr^{3+} c) both Al^{3+} and cr^{3+} ions d) ruby rods

8. Better spectrographs can be taken in a very short interval of time by using____

   a) Ordinary camera b) mobile camera

   c) LASER d) tracer

9. If the radius of second Bohrs orbit is 2.12 A.U., then the radius of first Bohrs orbit is,_____.

   a) 0.53 A.U. b) 5.3 A.U. c) 2.12 A.U. d) 10.6 A.U.

10. If L=2 and S=1 then j=?

    9) 1 b) 2 c) 3 d) 4

Total No. of Printed Pages: 3

SUBJECT CODE NO: - Y-2030
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. T.Y (Sem-VI)
Examination March / April - 2023
Physics Paper-XX (Non -Conventional Energy Sources and Optical Fiber)

[Time: 01:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B i) solve all questions
ii) Draw the neat diagram whenever necessary

Q1 a) Discuss in detail 'Geothermal energy, as source of non-conventional energy give its advantages and disadvantages 10

b) Explain in detail the current-Voltage characteristics of solar photovoltaic cell with neat diagrams. 10

OR

a) What is optical fibre & State types of optical fibre Explain in detail mono-mode step index fibre with suitable diagram. 10

b) Discuss testing of optical fibre cable in detail, Also, give standard tests performed for testing. 10

Q2 a) Give Advantages of Biomass energy 05

b) Write short note on tapered fibre. 05

c) Give Limitations of wind energy 05

d) Estimate the numerical aperature and acceptance angle of an optical fibre having refractive index 1.54 (core) and refractive index 1.50 (cladding) Optical Fibre is in air. ($\mu_o = 1$) 05

OR

a. Explain the terms i) fill factor of solar cell ii) Efficiency of solar cell. 05

b. write note on strength members in OFC 05

c. calculate the fill factor for solar cell having following parameters. 05

V_{oc} = 0.25V, I_{sc} = 6mA, V_m =0·15 V I_m = 3.5mA.

d. Estimate the strain produced in optical Fibre on bending it through radi us of 8cm. [Given:- radius of cladding 175 μm] 05

Q3 Choose the correct Answer 10

1. In vertical axis wind turbine, the blade of wind turbine rotate around....
   a) vertical axis
   b) Horizontal axis
   c) The axis is inclined at 45°
   d) None of the above
2. Which one of the following renewable energy is storable.
   a) Hydro energy b) wind energy
   c) Tidal energy d) solar energy
3. Semiconductor doped with trivalent impurity is called as_____ semiconductor
   a) p-Type b) N-Type c) P-N d) p-N
4. An electrolyte used in Lead-Acid battery is.....
   a) dilute sulphuric acid
   b) Hard water
   c) Acetic Acid
   d) soft water
5. optical fibres are good_____
   a) dielectrics b) conductors c) Insulators d) Both a & c
6. attenuation in optical fibre can be measured in _____
   a) dB/km b) dB/m c) KdB/m d) dB m/m
7. Transmission signal through optical Fibre is of the form of .....
   a) sound b) Electricity c) light d) None of these.
8. Recommended limited tensile force for cable and duct installation is about_____
   a) 182 kg b) 200kg c) 100 kg d) 150kg

9. Attenuation in optical Fibre is _____
    a) Lower than coaxial fibres
    b) Higher than co-axial fibres
    c) same as that of co-axial fibres
    d) None of these.
10. The Fixed dome type biogas plant has been adopted on large scale in _____

    a) china b) us c)India d) Japan