

PHSACOR1P 2022-23



1. Plot a $f(x)=x^2$. Prepare contour with colorbar of the function $f(x,y) = \exp(-x^2)\exp(-y^2)$
2. The first term and common difference of an AP series are 3 and 5 respectively. Using for and while loops find the 8th term of the series and find summation of first eight terms.
3.

x	2	4	6	8	10	12
y	4.97	9.012	13.02	16.95	21.11	25.02

Fit the above data using Least square fitting method. Display the fit with the original data points.
4. Define a user define a function to generate a linspace function having start=1, stop=10, number=15.
5. Create a three column data (x,y,z) file using a text editor. Read it from python. Find the sum and standard deviation of y and z.
6. The first term and common ratio of a GP series are 2 and 3 respectively. Using for and while loops find the 8th term of the series and find summation of first eight terms.
7. Defining a user define function to compute the double factorial of 3 and 6.
8. Define a user define function to generate a Fibonacci sequence having first term 2 and second term 3. Print your output in a list containing nine terms.



PHSACOR01P

2021-22

1.

x	2	4	6	8	10	12
y	4.97	9.012	13.02	16.95	21.11	25.02

Fit the above data using Least square fitting method. Display the fit with the original data points.

2. Create a three column data (x,y,z) file using a text editor. Read it from python. Find the sum and standard deviation of y and z.

3. Defining a user define function to compute the double factorial of 5 and 8.

4. The first term and common difference of an AP series are 5 and 3 respectively. Using for and while loops find the 8th term of the series and find summation of first eight terms.

5. Define a user define function to generate a Fibonacci sequence having first term 1 and second term 2. Print your output in a list containing nine terms.

6. Plot a $f(x)=x^2$. Prepare contour with colorbar of the function $f(x,y) = x^2\exp(-x^2)y^2\exp(-y^2)$

7. The first term and common ratio of a GP series are 3 and 2 respectively. Using for and while loops find the 8th term of the series and find summation of first eight terms.

8. Define a user define a function to generate a linspace function having start=5, stop=15, number=10.



PHSACOR5P 2022-23

1. Plot user defined functions $f(x)=\sec^2(x)$ in the range $[0:\pi/4]$ along with their derivatives using forward difference formula on the same graph. Also the derivatives evaluated calculated using derivative library function in scipy are to be plotted on it for comparison.
2. Evaluate the integration of $f(x) = \cos(x)$ from $\pi/2$ to 2π using Monte Carlo random dot method. Plot the accepted dots and rejected dots on the same graph along with the function using matplotlib.
3. Plot the directional dependence of potential for an electric dipole and an electric quadrupole. Retrieve the values of boltzmann constant, mass of proton in Kg with their values, units and uncertainty in measurements using scipy.

4.

x	1	3	5	7	9	11
y	1.000	5.196	11.180	18.520	27.000	36.483

Using suitable interpolation algorithm find the values at $x=2$ and $x=10$

5. Plot a user defined function $f(x) = x^2$ in the range $[0:4]$ and its integral on the same graph using trapezoidal rule. Plot the integral using library function quad in scipy for comparison.
6. Estimate the area of a circle of radius $r=1.5$ and an ellipse of major axis of length 3.0 and minor axis of length 1.5 using stochastic method.
7. Use scipy to generate Legendre polynomials and Bessel functions of different orders and to plot those using matplotlib over a range. Plot the Fraunhofer diffraction pattern for a circular aperture.
8. Perform online graph plotting of the function $\cos(x)$ in the range $[0:2\pi]$. Create a 2D array of dimension 4×3 . Then slice a 2×2 block from it.
9. Implement sorting algorithms on a collection of data using Bubble sort and Insertion sort.
10. Plot a user defined function $f(x) = x^2$ in the range $[0:4]$ and its integral on the same graph using Simpson's 1/3 rd rule. Plot the integral using library function quad in scipy for comparison.

11.

x	10	12	14	16	18	20
y	3.162	3.464	3.742	4.000	4.243	4.472

Using suitable interpolation algorithm find the values at $x=11$ and $x=19$

12. Estimate the area of a circle of radius $r=4.0$ and an ellipse of major axis of length 8.0 and minor axis of length 4.0 using stochastic method.



PHSACOR05P 2021-22

- 1) Create a two dimensional array (5×5). Then find the trace of the array. Generalize the program for any array of dimension ($n \times n$).
- 2) Create a two dimensional array (3×3) such that all the elements are -1 (use specific command) Then find the trace of the array.
- 3) Create three column data. Plot column 2 vs. column 1 and column 3 vs. column 1 in a same graph using different line styles.
- 4) Plot a user define function $\sin(x)/x$.
- 5) Plot the directional dependence of potential for an electric quadrupole for a given value of distance.
- 6) Create a one dimensional array containing six real elements. Then convert it into a two dimensional array of suitable dimension.
- 7) Create two arrays of dimension 2. Then them merge column-wise such that one can evaluate determinant of the final array.
- 8) Using Scipy generate Legendre polynomial of order 3. Also create the same polynomial function without using Scipy. Then plot both of the in a same graph.
- 9) Create a two dimensional array (4×4). Then find the trace of the array. Generalize the program for any array of dimension ($n \times n$).
- 10) Plot the directional dependence of potential for an electric dipole for a given value of distance.
- 11) Create two arrays of dimension 2. Then them merge row-wise such that one can evaluate determinant of the final array.
- 12) Using Scipy generate Legendre polynomial of order 2. Also create the same polynomial function without using Scipy. Then plot both of the in a same graph.
- 13) Using Numpy Find the angle between the vectors $3\hat{i}+4\hat{j}+7\hat{k}$ and $1\hat{i}+2\hat{j}+9\hat{k}$.
- 14) Plot a user define function $\frac{\log(1+x)}{x}$.
- 15) Check whether these vectors are co-planer $3\hat{i}+4\hat{j}+7\hat{k}$, $1\hat{i}+2\hat{j}+9\hat{k}$, $6\hat{i}+8\hat{j}+14\hat{k}$.
- 16) Plot the function $x^{-1.5}$. Choose the scale in such a way that the function appears as a straight line in the plot.
- 17) Create a one dimensional array containing nine real elements. Then convert it into a two dimensional array of suitable dimension in such a way that one can evaluate the determinant of the final array.



18) Using Numpy Find the angle between the vectors $3\hat{i}+4\hat{j}+7\hat{k}$ and $1\hat{i}+2\hat{j}+9\hat{k}$.

19) Create a one dimensional array containing six real elements. Then convert it into a two dimensional array of suitable dimension.

20) Plot a user define function $\frac{\log(1+x)}{x}$.

21) Create three column data. Plot column 2 vs. column 1 and column 3 vs. column 1 in a same graph using different line styles.

22) Check whether these vectors are co-planer $3\hat{i}+4\hat{j}+7\hat{k}$, $1\hat{i}+2\hat{j}+9\hat{k}$, $6\hat{i}+8\hat{j}+14\hat{k}$.

23) Create a two dimensional array (4×4). Then find the trace of the array. Generalize the program for any array of dimension ($n \times n$).

Thermal Physics



1 (a) Deduce the reduced form of Maxwell's speed distribution law

(b) Consider a ~~non~~ non-rigid diatomic molecule. Calculate $\gamma = \frac{C_p}{C_v}$ of a gas which contains such ~~non-rigid~~ non-rigid molecules

(c) Find the mean of the reciprocal of ~~the~~ velocity of the molecules in an ideal gas at temperature T , if m be the mass of the molecule. $(2.5 + 2.5 + 3 = 8)$

2 (a) Deduce the Einstein's equation for Brownian motion

(b) What do you mean by mean free path. Find the most probable energy of an ideal gas at temperature T . $(4 + (1+3) = 8)$



Internal assessment

SEM-3, Physics (Hons), Paper-CC-7 (Theory), Session: 2022-23

FM: 16

Time: 45 Minutes

- 1) Design a synchronous counter for sequence: 7,6,5,4,3,2,1,0 5
- 2) Prove the Boolean identity : $AB + B\bar{C} + \bar{A}(B+C) + \bar{B}C + \bar{A}\bar{B}\bar{C} + ABC = \bar{A} + B + C$ 2
- 3) Convert: $(B7D)_{16}$ in to Octal number system 2
- 4) What do you mean by edge triggering and level triggering? 2
- 5) Design a full adder using NAND gates only. Steps of calculation in designing are required. 3
- 6) Convert D flip-flop to a J-K flip-flop 2



FM: 16

Time: 45 Minutes

- 1) Design synchronous counter for sequence: 0, 1, 3, 5, 7, 6, 4, 2, 0 6
- 2) What type of wave is applied in the horizontal plates of CRO? Explain the reason. 1+2
- 3) Convert: $(A9E)_{16}$ in to Octal number system 2
- 4) Find the Boolean expression for the following truth table and simplify the expression using K-Map 2+3

A	B	C	D	Y
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Or

Multiplexer Logic

a) Given the function $Z = B'C + A'BD + AB'$, fill in the truth-table below.

A	B	C	D	Z
0	0	0	0	
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

B.Sc. Physics Semester-IV, 2022-23
Barasat Government College
Mathematical Physics III
PHSACOR08T



Time: 50 minutes

Full Marks: 16

Notations have their usual meanings.

1. (a) Let c be the arc of circle $|z| = 2$ from $z = 2$ to $z = 2i$ that lies in the first quadrant. Without evaluating the integral show that $|\int_c \frac{dz}{z^2-1}| \leq \frac{\pi}{3}$.
- (b) Find the roots of the z , where $z^4 = -81$.
- (c) Applying the calculus of residues evaluate $\int_{-\infty}^{\infty} \frac{\sin x}{x} dx$. 2+2+4
2. (a) If $F(\omega)$ is the Fourier transform of $f(x)$, find the Fourier transform of $f(x) \cos(ax)$. Here a is a constant.
- (b) Find the Fourier transform of the Dirac-delta function $\delta(x - a)$ where a is a constant.
- (c) Find the Fourier cosine transform of $f(x) = \frac{1}{1+x^2}$. 2+2+4

PHSACOR08T 2021-22



1. Find the inverse of the following matrix using Gauss Jordan method

$$A = \begin{bmatrix} 3/2 & 1/2 \\ 1/2 & 3/2 \end{bmatrix}$$

2. Solve the differential equation using RK2 and RK4 methods $\frac{dx}{dt} = \sin(3\pi t)$ with initial value of $x = 2$ at $t = 0$.

3. Find the largest eigenvalue of the following matrix using by power iterative method

$$A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$$

4. Solve these linear equations using Gauss method $2x + 5y = -1$ and $x + 2y = 8$.

5. Solve the differential equation using Euler and RK2 methods $\frac{dx}{dt} = \cos(3\pi t)$ with initial value of $x = 0$ at $t = 0$.

6. Find the inverse of the following matrix using Gauss Jordan method

$$A = \begin{bmatrix} 5/2 & 3/2 \\ 3/2 & 5/2 \end{bmatrix}$$

7. Find the largest eigenvalue of the following matrix using by power iterative method

$$A = \begin{bmatrix} 3 & 4 \\ 4 & 3 \end{bmatrix}$$

8. Find the orthonormal set of vectors from the following vectors $\vec{a} = 1\hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = 3\hat{i} - 1\hat{j} + 1\hat{k}$ and $\vec{c} = 1\hat{i} + 1\hat{j} - 2\hat{k}$.

9. Solve the differential equation using RK2 and RK4 methods $\frac{dx}{dt} = \sin(2.5\pi t)$ with initial value of $x = 4$ at $t = 0$.

10. Find the largest eigenvalue of the following matrix using by power iterative method

$$A = \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix}$$

11. Find the orthonormal set of vectors from the following vectors $\vec{a} = 1\hat{i} + 2\hat{j} - 1\hat{k}$, $\vec{b} = 0\hat{i} + 5\hat{j} - 3\hat{k}$ and $\vec{c} = -4\hat{i} + 1\hat{j} + 3\hat{k}$.

12. Solve these linear equations using Gauss method $5x + 11y = 21$ and $3x + 7y = 20$.



13. Find the largest eigenvalue of the following matrix using by power iterative method

$$A = \begin{bmatrix} 3 & 1 \\ 1 & 2 \end{bmatrix}$$

14. Find the inverse of the following matrix using Gauss Jordan method

$$A = \begin{bmatrix} 2 & 2 \\ 3 & 7 \end{bmatrix}$$

15. Solve these linear equations using Gauss method $7x + 3y = 11$ and $2x + 5y = 2$.

16. Solve the differential equation using Euler and RK2 methods $\frac{dx}{dt} = \cos(1.5\pi t)$ with initial value of $x = 0$ at $t = 0$.

17. Solve these linear equations using Gauss method $3x + 7y = -17$ and $2x + y = 10$.

18. Find the inverse of the following matrix using Gauss Jordan method

$$A = \begin{bmatrix} 5 & 2 \\ 3 & 7 \end{bmatrix}$$

19. Find the orthonormal set of vectors from the following vectors $\vec{a} = 1\hat{i} + 0\hat{j} + 1\hat{k}$, $\vec{b} = 1\hat{i} + 0\hat{j} - 1\hat{k}$ and $\vec{c} = 0\hat{i} + 3\hat{j} + 4\hat{k}$.

20. Solve the differential equation using Euler and RK2 methods $\frac{dx}{dt} = \sin(1.5\pi t)$ with initial value of $x = 0.5$ at $t = 0$.

21. Find the inverse of the following matrix using Gauss Jordan method

$$A = \begin{bmatrix} 2/3 & 2 \\ 2 & 2/3 \end{bmatrix}$$

22. Find the orthonormal set of vectors from the following vectors $\vec{a} = 2\hat{i} + 0\hat{j} + 2\hat{k}$, $\vec{b} = 2\hat{i} + 0\hat{j} - 2\hat{k}$ and $\vec{c} = 0\hat{i} + 6\hat{j} + 8\hat{k}$.

23. Solve the differential equation using Euler and RK4 methods $\frac{dx}{dt} = \sin(1.5\pi t)$ with initial value of $x = 0.5$ at $t = 0$.



BARASAT GOVT COLLEGE

Subject: Physics (Hons), SEM-IV

Internal Examination-1 - 2023

Paper Code: PHSACOR10T (Analog Systems and Applications)

Time: 1/2 Hour

FM:10

- a) A 6V Zener diode is connected in series with a 100Ω resistance and a load of $0.5k\Omega$ connected across the diode. The maximum allowable current through the Zener diode is 30mA. Calculate the operating range of the input voltage. 2
- b) Why do Si or Ge diode not emit light but GaAs diodes do? Explain with diagram 2
- c) Write down the advantages and disadvantages of Bridge rectifier over centre-tap rectifier. 2
- d) Why thermal noise in a CE mode circuit is much higher than that in a CB mode circuit? 2
- e) The value of α of a transistor is 0.98. If it changes by 1% what would be the corresponding percentage change in the value of β ? 2

BARASAT GOVT COLLEGE

Subject: Physics (Hons), SEM-IV

Internal Examination - 2021

Paper Code: PHSACOR10T (Analog Systems and Applications)



Time: 1 Hour

FM:20

- a) What is thermal runaway in transistor? 2
- b) A 6V Zener diode is connected in series with a 100Ω resistance and a load of $0.5k\Omega$ connected across the diode. The maximum allowable current through the Zener diode is 30mA. Calculate the operating range of the input voltage. 2
- c) Distinguish between the static and dynamic resistances of a p-n junction diode. Do they depend on temperature and bias voltage? 2
- d) The reverse saturation current of a p-n junction diode is $20\mu A$ at 300K. Find the voltage to be applied to obtain a forward current 0.75mA. ($k_B = 1.38 \times 10^{-23}$ J/K) 2
- e) Derive an expression to show the effect of negative feedback on voltage gain in an amplifier. 2
- f) What is virtual ground in OP-AMP? Explain with diagram? 2
- g) Explain with circuit diagram the emitter bias of transistor amplifier. Determine the stability factor for this type of transistor biasing. 4
- h) Draw the circuit diagram for Colpitts and Hartley oscillators. Which frequency ranges are suitable for these two types of oscillator. 4

B.Sc. SEM-5 Physics General Internal Assessment (DSE-Theory)-2020



1. In room temperature for an Intrinsic semiconductor
 - a) Number of free electron is greater than number of free whole
 - b) Number of free whole is greater than number of free electron
 - c) Number of free electron is equal to number of free whole
 - d) No free electrons and free wholes are present

- 2) Which of the following is a semi-conductor
 - a) Aluminium
 - b) Arsenic
 - c) Phosphorous
 - d) Gallium arsenide

- 3) For a Silicon diode, the barrier potential (V_b) is approximately equal to
 - a) 0.3 Volt
 - b) 1.1 Volt
 - c) 5.6 Volt
 - d) 0.7 Volt

- 4) Ripple factor of a half wave rectifier is
 - a) 0.48
 - b) 2.5
 - c) 1.21
 - d) 0.61

- 5) The 1's Complement equivalent number if the decimal number -15 is
 - a) 01111
 - b) 10000
 - c) 10010
 - d) -1111

- 6) The Boolean expression of an AND gate is
 - (a) $Y=A.B$
 - (b) $Y=A+B$
 - (c) $Y=A/B$
 - (d) None of these

- 7) The 2's complement of 1001 is
 - (a) 0110
 - (b) 1011
 - (c) 0111
 - (d) 1110

- 8) According to Boolean algebra, the value of $A+AB$ is
 - (a) B
 - (b) AB
 - (c) A+B
 - (d) A

B.Sc. SEM-5 Physics General Internal Assessment (SEC)-2020



1. The main components of a Cathode Ray Tube (CRT) is/are
 - (a) Electron gun
 - (b) Deflection system
 - (c) Fluorescent screen
 - (d) All of these
2. The pressure within the funnel in which CTR is kept is
 - (a) 10^{-5} mm Hg
 - (b) 10^{-6} mm Hg
 - (c) 10^{-5} cm Hg
 - (d) 10^{-6} cm Hg
3. The deflection sensitivity of a CRT is 0.02 mm/volt. If the voltage applied between the vertical plates is 500 Volt. Then the displacement of light is
 - (a) 4 mm
 - (b) 4 cm
 - (c) 10 cm
 - (d) 1 cm
4. A CRO is used for the measurement of
 - (a) Shape of an a.c. voltage
 - (b) voltage, frequency and phase angle of a signal
 - (c) All of these
 - (d) None of these
5. The circuit necessary for production of saw-tooth wave is
 - (a) time-base circuit
 - (b) LR Circuit
 - (c) LCR circuit
 - (d) None of these
6. If 200 Volt is applied between the deflection plates of a CRO and deflection of light is observed by an amount of 2 cm. Find the value of the voltage for which deflection will be 4 cm
 - (a) 300 Volt
 - (b) 400 Volt
 - (c) 200 Volt
 - (d) 500 Volt
7. The fluorescent screen of a CRT is made of
 - (a) Zinc orthosilicate
 - (b) Zinc orthomanganate
 - (c) Zinc orthocarbonet
 - (d) None of these

8. The number of deflection plates in a CRT is

- (a) 2
- (b) 3
- (c) 4
- (d) 6

9. Electron produces in a CRT by

- (a) Anodes
- (b) Cathodes
- (c) Accelerating plates
- (d) Control grid

10. Voltage applied between the first accelerating anodes of a CRT is

- (a) 200-1000 V
- (b) 500-800 V
- (c) 2000-10000 V
- (d) None of these



INTERNAL PRACTICAL EXAMINATION – UG – SEMESTER 6 – 2020-21



PAPER CODE – PHSACOR13P

Full Marks – 20

Time – 1 hour

Attempt any 10 (Ten) questions from the following. All questions carry equal marks.

Marks → 2 x 10 = 20 Marks

- (1) Explain, in brief, the advantages in employing a PN junction diode to determine the value of Boltzmann constant.
- (2) What range values of current and volt meters along with applied voltage are used to calculate accurately the value of Boltzmann constant?
- (3) State the dimensions of Boltzmann constant and explain, in brief, its physical significance.
- (4) Do you know any other method to determine and estimate the value of Boltzmann constant?
- (5) Define Stefan-Boltzmann law of radiation and its units.
- (6) Why do we use a filament bulb and not LED bulb to determine Stefan's Law?
- (7) Explain the nature of the graph to estimate the value and verify the Stefan's Law.
- (8) How do we measure the emitted radiation in the experiment to establish the Stefan's Law?
- (9) What do you understand by the phrase "black-body radiation"? Explain properly with examples.
- (10) What are the optical components to setup the polarimeter experiment in order to study the Specific Rotation of sugar solution? Explain, in brief, about the optical components used.
- (11) (i) What is an 'Optically active substance'?
(ii) Do all substances exhibit identical optical activity? Explain with proper reasons.
- (12) How does the optical activity of a substance depend on (i) Wavelength of incident light, and (ii) temperature?
- (13) (i) Define Specific Rotation, and (ii) Differentiate between molecular rotation and rotatory dispersion.

X-----X-----X

INTERNAL PRACTICAL EXAMINATION – UG – SEMESTER 6 – 2021 – (AD sir)



PAPER CODE – PHSACOR13P

Full Marks – 20

Time – 1 hour

Attempt any 10 (Ten) questions from the following. All questions carry equal marks.

Marks → 2 x 10 = 20 Marks

- (1) Explain, in brief, the advantages in employing a PN junction diode to determine the value of Boltzmann constant.
- (2) What range values of current and volt meters along with applied voltage are used to calculate accurately the value of Boltzmann constant?
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- (4) Do you know any other method to determine and estimate the value of Boltzmann constant?
- (5) Define Stefan-Boltzmann law of radiation and its units.
- (6) Why do we use a filament bulb and not LED bulb to determine Stefan's Law?
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- (8) How do we measure the emitted radiation in the experiment to establish the Stefan's Law?
- (9) What do you understand by the phrase "black-body radiation"? Explain properly with examples.
- (10) What are the optical components to setup the polarimeter experiment in order to study the Specific Rotation of sugar solution? Explain, in brief, about the optical components used.
- (11) (i) What is an 'Optically active substance'?
(ii) Do all substances exhibit identical optical activity? Explain with proper reasons.
- (12) How does the optical activity of a substance depend on (i) Wavelength of incident light, and (ii) temperature?
- (13) (i) Define Specific Rotation, and (ii) Differentiate between molecular rotation and rotatory dispersion.

X-----X-----X

INTERNAL PRACTICAL EXAMINATION – UG – SEMESTER 6 – 2021 – (AD sir)



PAPER CODE – PHSACOR13P

Full Marks – 20

Time – 1 hour

Attempt any 10 (Ten) questions from the following. All questions carry equal marks.

Marks → 2 x 10 = 20 Marks

- (1) Explain, in brief, the advantages in employing a PN junction diode to determine the value of Boltzmann constant.
- (2) What range values of current and volt meters along with applied voltage are used to calculate accurately the value of Boltzmann constant?
- (3) State the dimensions of Boltzmann constant and explain, in brief, its physical significance.
- (4) Do you know any other method to determine and estimate the value of Boltzmann constant?
- (5) Define Stefan-Boltzmann law of radiation and its units.
- (6) Why do we use a filament bulb and not LED bulb to determine Stefan's Law?
- (7) Explain the nature of the graph to estimate the value and verify the Stefan's Law.
- (8) How do we measure the emitted radiation in the experiment to establish the Stefan's Law?
- (9) What do you understand by the phrase "black-body radiation"? Explain properly with examples.
- (10) What are the optical components to setup the polarimeter experiment in order to study the Specific Rotation of sugar solution? Explain, in brief, about the optical components used.
- (11) (i) What is an 'Optically active substance'?
(ii) Do all substances exhibit identical optical activity? Explain with proper reasons.
- (12) How does the optical activity of a substance depend on (i) Wavelength of incident light, and (ii) temperature?
- (13) (i) Define Specific Rotation, and (ii) Differentiate between molecular rotation and rotatory dispersion.

X-----X-----X

B.Sc. Physics Semester-VI, 2022-23
Barasat Government College
Statistical Mechanics
PHSACOR014T



Time: 50 minutes

Full Marks: 16

Notations have their usual meanings.

Answer **any four** questions.

4 × 4 = 16

1. If S be the entropy of a system then show that $S = K_B \ln \Omega$. Here Ω is the number of accessible micro states of the system.
2. A classical system consists with N non interacting particles. Each particle can take energy states $0, \epsilon$ and 2ϵ . Find the average energy and Helmholtz free energy of the system. 2+2
3. If ρ be the density of states of a system and \vec{v} is the velocity vector of the representative points in phase space, then prove that $\frac{\partial \rho}{\partial t} + \vec{\nabla}(\rho \vec{v}) = 0$.
4. Show that the probability of a system in the grand canonical ensemble to be in the energy state E_r with N_s number of particles is $P_{r,s} = \frac{e^{-\beta E_r - \alpha N_s}}{\sum_{r,s} e^{-\beta E_r - \alpha N_s}}$, where $\beta = 1/K_B T$, $\alpha = -\mu/K_B T$. Here μ is the chemical potential of the system. Hence find the expression for the average number of particles of the system. 3+1
5. Discuss the equivalence of ensembles. If the mean square fluctuations in energy of a system in equilibrium at temperature T is proportional to T^α . Then find how the average energy of the system depends on T . 2+2

Department of Physics
Barasat Government College



Internal Examination – May 2023
Semester – 6 (UG General)

Paper – Physics

Paper Code – PHSGDSE03T

Full Marks – 20

Time – 1 Hour

Short Questions – Answer any 5 (Five) questions from the following – 5 x 2 marks = 10 marks

1. Explain: All primitive cells are unit cell, but all unit cells are not primitive.
2. Calculate atomic number of a Face Centered Cubic crystal.
3. What are Type-I & Type-II superconductors?
4. What is Meissner Effect? Draw $\rho - T$ curve showing transition.
5. State the differences between p-type and n-type semiconductors with examples.
6. State the Heisenberg's Uncertainty Principle of a particle moving along x-axis.
7. How is a metal different from a dielectric material? Give proper examples.
8. Is copper a magnetic material? Explain briefly.

Long Questions – Answer any 2 (Two) questions from the following – 2 x 5 marks = 10 marks.

1. State and derive Bragg's law of X-ray diffraction.
2. State the rules to find the Miller indices of a lattice plane.
3. Write the wave function for a particle moving in one-dimension and the Time Independent Schrodinger equation.
4. Using Planck's quantum theory and Einstein's mass-energy relation, show that momentum of an electron is inversely proportional to its associated wavelength.

BARASAT GOVT COLLEGE
Subject: Physics (Hons), SEM-VI
Internal Examination - 2021
Paper Code: PHSADSE06T (Communication Electronics)



Time: 1 Hour

FM:20

1. An amplitude modulated voltage is given by

$$v_{AM}(t) = 50 \cos(10^7 t) [1 + 0.3 \cos(600 t) + 0.05 \cos(9000 t)]$$

Find all frequency components in Hz, find the modulation index for each term, bandwidth and power in side bands. 2+1+1+1

2. Compare PAM and PCM systems. What is the band width of BPSK signal? Determine the band-width of M-ARY FSK signal. 2+1+2
3. Using Kepler's law, estimate the orbital velocity of a Geosynchronous satellite and hence estimate round trip propagation delay between a satellite and an earth station located just below it. What are the advantages and disadvantages of Geosynchronous satellites? 2+1+2
4. Describe different type of satellite orbits. Determine the path-loss of a signal when travel from a transmitter on earth to satellite. 2+3

Date of Exam: 25/04/22



Internal Examination – April' 2022
Semester – 6 (General)

Paper – Physics

Paper Code – PHSGDSE03T

Full Marks – 20

Time – 1 Hour

Short Questions – Answer any 5 (Five) questions from the following – (2 marks x 5) = 10 marks

- 1) State the Einstein Relation for photons. *ফোটনের আর্ভাইনস্টাইন সম্পর্ক কী? লিখ।*
- 2) Write the expression for Energy and Wave function of free particle moving in One-Dimension. *এক দিকীয়া মুক্ত কণার Energy এবং Wave function - লিখ।*
- 3) Define Capacitance with dielectric medium for a parallel plate capacitor. *সমান্তরাল প্লেট ক্যাপাসিটর-এর ক্যাপাসিট্যান্সের সংজ্ঞা দিও।*
- 4) What is the gain in potential energy for a magnetic dipole in presence of external magnetic field? *বহিঃস্থ চৌম্বক ক্ষেত্রের উপস্থিতিতে চৌম্বক ডাইপোলের বিভব শক্তির বৃদ্ধি কত? লিখ।*
- 5) State the relation between Electric Flux Density and Polarisation in a Dielectric medium. *অমুদ্রকের ক্ষেত্রে Electric Flux Density ও পোলারাইজেশনের সম্পর্ক কী? লিখ।*
- 6) What are the differences between Crystal and Amorphous materials? *Crystal ও Amorphous - এর মধ্যে পার্থক্য লিখ।*
- 7) What is a Single crystal? *একক crystal কী? লিখ।*
- 8) What is Grain? *Grain কী? লিখ।*

Long Questions – Answer any 2 (Two) questions from the following – (5 marks x 2) = 10 marks

- 1) (a) Define unit cell. *Unit Cell - কী? সংজ্ঞা দিও।*
- (b) Is define cell unique? *Unit Cell - কি একক?*
- (c) What are the differences between unit cell and primitive cell? *Unit Cell এবং primitive cell - এর পার্থক্য লিখ।*
- (d) What is a 'Basis' of a crystal? *Basis - কী? [1+1+2+1]*
- 2) (a) Explain the types of microscopic polarization inside a dielectric medium. Give proper examples. *অমুদ্রকের ক্ষেত্রে কত ধরনের অণুবীক্ষণীয় পোলারাইজেশন সম্ভব? উদাহরণ দিও।*
- (b) State the Clausius – Mossotti equation relating the dielectric constant and polarizability of a dielectric medium. *অমুদ্রকের ক্ষেত্রে অমুদ্রক - ধ্রুবক ও পোলারাইজেশনের ক্ষমতার সম্পর্ক - ক্লাউসিয়াস-মসসোটি - এর সমীকরণ লিখ। [3+2]*
- 3) (a) Explain Gyromagnetic Ratio in magnetic materials. *চৌম্বক পদার্থের ক্ষেত্রে অণুবীক্ষণীয় গায়রোম্যাগনেটিক রেশিও কী? লিখ।*
- (b) Discuss Paramagnetic, Diamagnetic and Ferromagnetic materials. Give proper Examples. [2 + 3] *প্যারাম্যাগনেটিক, ডায়াম্যাগনেটিক, ফেরোম্যাগনেটিক পদার্থের সংজ্ঞা এবং উদাহরণ লিখ।*



1. An interpreter converts a high level language to a machine language by
 - (a) as a whole
 - (b) line by line
 - (c) can't be said
 - (d) do nothing
 Ans. (b)
2. A compiler converts a high level language to a machine language by
 - (a) as a whole
 - (b) line by line
 - (c) can't be said
 - (d) do nothing
 Ans. (a)
3. How many types of constants are there in the fortran language?
 - (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
 Ans. (c)
4. * is a-
 - (a) numerical character
 - (b) alphabetical character
 - (c) special character
 - (d) None of these
 Ans. (c)
5. I, J, K, L, M are-
 - (a) real variables
 - (b) integer variables
 - (c) both real and imaginary variables
 - (d) none of these
 Ans. (b)
6. $x^2 + \sin x + e^{2x}$ is expressed in fortran language as-
 - (a) $x*2 + \sin*x + \exp(2x)$
 - (b) $x*2 + \sin(x) + \exp*(2x)$
 - (c) $x**2 + \sin(x) + \exp(2x)$
 - (d) $x**2 + \sin(x) + \exp(2*x)$
 Ans. (d)
7. If J=5, then the value of FLOAT(J) is-
 - (a) 5.0
 - (b) 5
 - (c) 0
 - (d) none of these
 Ans. (a)
8. $x \geq 2$ is written in fortran language as-
 - (a) $x \geq 2$
 - (b) $x.EQ.2$
 - (c) $x.LT.2$
 - (d) $x.GE.2$
 Ans. (d)
9. If J=3, then the value of $J/5 + J*3 + 2/3 + J**2$ is
 - (a) 19.6
 - (b) 18
 - (c) 19
 - (d) 20
 Ans. (b)
10. Which one is a library function?
 - (a) $\sin(x)$
 - (b) $\cos(x)$
 - (c) $\text{atan}(x)$
 - (d) all of these
 Ans. (d)

B.Sc. Sem1 Physics General Internal Assessment (Theory)-2020



- If the torque applied on a body is zero, which quantity of that particle conserves?
(a) Mass (b) Angular momentum (c) Linear momentum (d) Acceleration
- Which are the Galilean transformation equations:
(a) $x = x' + vt$, $y = y'$, $z = z'$ (b) $x' = x$, $y = y'$, $z = z'$ (c) $x = x' - vt$, $y = y'$, $z = z'$ (d) None of these
- If a body of mass 0.5 Kg moves with an acceleration of 10 m/s upon the application of an external force F, the value of F in Newton (N) is
(a) 10 N (b) 0.5 N (c) 50 N (d) 5 N
- If \vec{F} is a conservative force, which one is correct?
(a) Gradient $\vec{F} = 0$ (b) Divergence $\vec{F} = 0$ (c) Curl $\vec{F} = 0$ (d) None of these
- The force of gravitational attraction between two masses of M and m is
(a) $F = -GMm/r^2$ (b) $F = GMm/r^3$ (c) $F = GMm/r$ (d) $F = -GMm/r$
- Mathematical form of Kepler's third law is
(a) $T^2 \propto a^2$ (b) $T^2 \propto a$ (c) $T^2 \propto a^3$ (d) None of these
- The distance of a geosynchronous artificial satellite from the earth's surface is-
(a) 42500 KM (b) 6400 KM (c) 86400 KM (d) 36100 KM
- In an artificial satellite, the weight of a body becomes
(a) Infinite (b) Zero (c) Half (d) Double

B.Sc. Sem3 Physics General Internal Assessment (Theory)-2020



- The ratio of most probable, average and r.m.s. velocity a gas molecule is
 - $C_m : C_a : C_{r.m.s.} = 1 : 1.225 : 1.128$
 - $C_m : C_a : C_{r.m.s.} = 1.225 : 1 : 1.128$
 - $C_m : C_a : C_{r.m.s.} = 1 : 1.128 : 1.225$
 - None of these
- The number of degrees of freedom of a diatomic gas molecule is
 - 5
 - 6
 - 3
 - 9
- Ratio of two specific heats for a triatomic molecule is?
 - 1.67
 - 1.40
 - 1.53
 - 1.33
- According to the equi-partition partition law of energy, the kinetic energy distributed to degrees of freedom is
 - $\frac{1}{2} RT$
 - $\frac{1}{2} KT$
 - 0
 - $2KT$
- Consider the uniform motion of a particle along OX axis. The phase space diagram of motion will be
 - an ellipse
 - a straight line parallel to x axis
 - a straight line parallel to P_n axis
 - a straight line parallel to x- P_n plane
- Consider two distinguishable particles. They are distributed among two phase cells. The number of macrostate will be
 - 1
 - 2
 - 3
 - 4
- The thermodynamic probability is related to the entropy of a system by $S = k \ln W$, then
 - W can be a negative quantity
 - W is always greater than 1
 - W can not be equal to one
 - W is a natural number
- As per Plank's quantum theory, the entropy of a one-dimensional harmonic oscillator is
 - $E = \hbar \omega$
 - $E = n \hbar \omega$ $[n=1,2,3,\dots]$
 - $E = (n+\frac{1}{2}) \hbar \omega$ $\{n=0,1,2,\dots\}$
 - $E = n \hbar \omega$ $[n=0, 1,2,\dots]$