K24U 0074

Reg. No.: .....

Name : .....

Sixth Semester B.Sc. Degree (C.B.C.S.S.-OBE – Regular/Supplementary/ Improvement) Examination, April 2024
(2019 to 2021 Admissions)
DISCIPLINE SPECIFIC ELECTIVE IN PHYSICS
6B14PHY(1) : Python Programming

Time : 3 Hours Max. Marks : 40

PART – A

Short answer questions, answer **all** questions. **Each** question carries **1** mark.

1. Which are the two modes of using Python ?
2. Write a python instruction to read an integer from the keyboard and save as 'n'.
3. The value of the python expression 3*9**1/2 is _____
4. Write the python instruction to import pi, sin function and cos function from the numpy module.
5. What is the output of the program :

```
for i in range (5) :
    if i == 3 :
    continue
    print (i, i **2)
```

6. Write python code to create an array of integers from 5 to 10, (including 5 and 10). **(6×1=6)**

PART – B

Short essay questions, answer **any 6** questions. **Each** question carries **2** marks.

7. List the rules to name an identifier.
8. With example explain any two manipulations of list.

P.T.O.

9. Explain any two built in functions in python.

10. Write a program to find the factorial of an integer using the module math or numpy.

11. What do you mean by vectorized functions ?

12. Explain the instructions continue and break.

13. Write the syntax and explain the for loop.

14. Explain polar() in matplotlib. **(6×2=12)**

PART – C

Problems, answer **any 4** questions. **Each** question carries **3** marks.

15. Write a program to read the coefficients of a quadratic equation and print its roots.

16. Briefly explain the data types supported by python.

17. Explain how user defined functions are created in python.

18. Write a python program to find dot product of two vectors. Read the x, y and z components from the key board and store it as an array.

19. Explain any three methods to create numpy arrays. Give one example for each.

20. Write a python program to plot cos function in the range 0 to 6π. **(4×3=12)**

PART – D

Long essay questions, answer **any 2** questions. **Each** question carries **5** marks.

21. List various Operators in python.

22. Explain if-elif-else structure in python.

23. Write notes on Saving and restoring arrays. Explain with suitable example.

24. Explain the plot() in the matplolib module. Write a python program to plot the trajectory of a projectile. **(2×5=10)**

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K23U 0529

Reg. No. : .....

Name : .....

VI Semester B.Sc. Degree (CBCSS – OBE-Regular/Supplementary/ Improvement) Examination, April 2023
(2019 and 2020 Admissions)
DISCIPLINE SPECIFIC ELECTIVE IN PHYSICS
6B14PHY (1) : Python Programming

Time : 3 Hours Max. Marks : 40

PART – A

(Short answer questions, answer **all** questions. **Each** question carries **1** mark.)

1. Who developed python programming language ?
2. The output of >>>2**3 is _____
3. What is the output of the program ?

```
>>> for i in range (10) :
    print (i)
    if i = =2 :
        break
```

4. The keyword is used to define the block of statement in the function is _____
5. Name any two array attributes.
6. What is the output of the following python program ?

```
>>> A = [1, 2, 3, None, (), [ ] ]
>>> print (len(A))
```

(6×1=6)

P.T.O.

PART – B

(Short essay questions, answer **any 6** questions. **Each** question carries **2** marks.)

7. Name the various data types used in python language.
8. List the rules to name an identifier.
9. Define recursive function.
10. Write the syntax of the 'if else' block with an example.
11. Write a program to create a NumPy array of five zeros of dimension 1.
12. Write a python program to plot a cosine wave from 0 to 2π.
13. Given S = '0123456789' write a python code to remove the first and last elements and print.
14. Write a python program to check the given number is even or odd. **(6×2=12)**

PART – C

(Problems, answer **any 4** questions. **Each** question carries **3** marks.)

15. What is a function in Python ? What are the advantages of using a function ? What is the difference between user-defined function and built in function ?
16. Write a python code to plot the curve $y = x^2$ with the axes labelled and title in the graph.
17. Explain how to calculate the derivative of a function using python.
18. Distinguish lists and tuples in python.
19. How will you calculate dot product and cross products in python ? Write a python code to perform dot and cross operation among two vectors.
20. Write a python program to obtain multiplication table of a given number entered by the user. **(4×3=12)**

PART – D

(Long essay questions, answer **any 2** questions. **Each** question carries **5** marks.)

21. What are modules in Python ? How will you import them ? Explain the concept by creating and importing a module.

22. Explain with suitable example the different operators in Python.

23. Explain the use of while and for loops in Python programming.

24. Explain the plotting of mathematical functions in Matplotlib. Write a Python program to plot Plank's curves. **(2×5=10)**

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K24U 0073

Reg. No.: .....

Name : .....

Sixth Semester B.Sc. Degree (C.B.C.S.S.-OBE – Regular/Supplementary/ Improvement) Examination, April 2024
(2019 to 2021 Admissions)
CORE COURSE IN PHYSICS
6B13 PHY : Electrodynamics and Circuit Theory

Time : 3 Hours Max. Marks : 40

SECTION – A

Short answer. **Six** questions. Answer **all** questions. **Each** question carries **1** mark.

1. What is the differential form of Faradays law ?
2. Which is the extra term introduced by Maxwell in order to correct the Ampere's law ?
3. Define Poynting theorem.
4. What is super position theorem ?
5. What is transient current ?
6. A series L-C-R circuit will have unity power factor if operated at a frequency of _____ **(6×1=6)**

SECTION – B

Short essay. **Eight** questions. Answer **any six** questions. **Each** question carries **2** marks.

7. How did Maxwell fix Ampere's law ?
8. Derive the continuity equation of charges.
9. What are gauge transformations ? Write down Lorentz gauge condition.
10. Define a plane wave. Write the general expression for an electric field in free space.
11. Show that magnetic components of an electromagnetic wave satisfies wave three dimensional wave equation in free space.

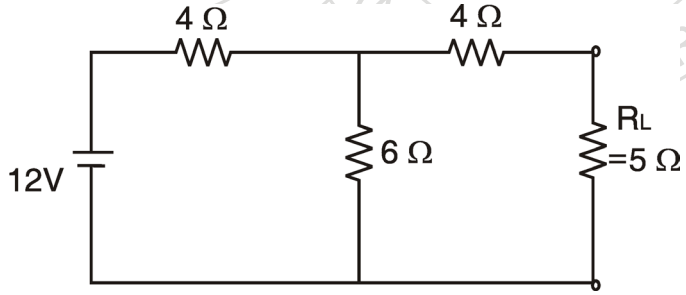
P.T.O.

12. How to Thevenize a given circuit ?
13. State explain maximum power transfer theorem.
14. Show that in pure capacitive circuit A.C current leads the applied voltage by $\frac{\pi}{2}$ degree. **(6×2=12)**

SECTION – C

Problems. **Six** questions. Answer **any four** questions. **Each** question carries **3** marks.

15. Find the energy stored in the toroidal coil with rectangular cross section inner radius *a* outer radius *b*, height *h* having *N* turns.
16. A coil of resistance 100 Ω is placed in a magnetic field of 1*mWb.* The coil has 100 turn and a galvanometer 400 Ω resistance is connected in series with it. Find the average e.m.f. and the current if the coil is moved in $\frac{1}{10}^{th}$ second from the given field to a field of 0.2 *mWb*.
17. A plane polarised electromagnetic waves in air is given by $E(x, y) = 5\hat{j}e^{i(3x+4z)}$. Find the frequency and wave length of the wave.
18. A plane polarised electromagnetic wave $E(z) = 10 \cos (8z - \omega t)\hat{i}$ incident normally on plane dielectric boundary having refractive indices ($n_1 = 1.6$ and $n_2 = 1$). Show that R + T = 1.
19. Use Thevenins theorem to find the current through 5 Ω resistor in the following circuit.



20. A coil takes a current of 6 Amp when connected to a 24-volt d.c supply. To obtain the same current with 50-Hz A.C supply, the supply voltage required was 30 V. Calculate the inductance and the power factor of the coil. **(4×3=12)**

SECTION – D

Long Essay. **Four** questions. Answer **any two** questions. **Each** question carries **5** marks.

21. State Poynting theorem. Derive its mathematical expression and calculate the average value of Poynting vector.

22. Derive the reflection (R) and transmission (T) coefficients in the case of normal incident and show that R+T = 1.

23. State Norton's Theorem. With the help of a neat diagram explain how a circuit can be Nortonized.

24. Explain A.C through pure resistive and pure inductive circuit separately, find out the relation between current and voltage in each circuit and also calculate average power per cycle in each circuit. **(2×5=10)**

KANNUR UNIVERSITY

K23U 0528

Reg. No. : .....

Name : .....

VI Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, April 2023
(2019 and 2020 Admissions)
CORE COURSE IN PHYSICS
6B13 PHY : Electrodynamics and Circuit Theory

Time : 3 Hours Total Marks : 40

SECTION – A **(6 Marks)**

Short answer. **Six** questions. Answer **all** questions. **Each** question carries **1** mark.

1. Write down Neumann integral formula for the mutual inductance of two coils.
2. Give the relation between wavelength and wave number of electromagnetic waves.
3. SI unit of $\frac{1}{\sqrt{\mu_0 \in_0}}$ is
4. Ideal constant current source is that voltage source whose internal resistance is
5. If C and R represent the capacitance and resistance then the unit of RC is
6. If the impedance of an AC circuit is 3+ 3j, $\left(\text{Here } j = \sqrt{-1}\right)$ then the phase difference between current and applied voltage is **(6×1=6)**

SECTION – B **(12 Marks)**

Short essay. **Eight** questions. Answer **any six** questions. **Each** question carries **2** marks.

7. Give the differential equations for time varying electric scalar potential V and magnetic vector potential A in the Lorentz Gauge condition.

P.T.O.

8. Obtain an expression for current density in a conductor in terms of electric field.

9. How momentum conservation is rescued in electrodynamics even though Newton's third law does not hold in electrodynamics ?

10. Maxwell's equations beg for magnetic charge to exist. Explain.

11. From Maxwell's equations in vacuum, derive the three-dimensional wave equation for electric field E.

12. State reciprocity theorem for a linear electrical network.

13. Illustrate delta to star conversion in electric networks with diagrams and write down the equation for conversion of resistances.

14. What do you mean by wattless current ? **(6×2=12)**

SECTION – C **(12 Marks)**

Problems. **Six** questions. Answer **any four** questions. **Each** question carries **3** marks.

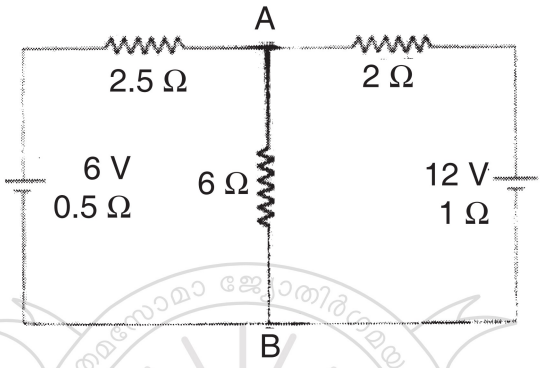
15. Find the self-inductance of a toroidal coil with rectangular cross section of inner radius a, outer radius b, height (or thickness) h, that carries a total of N turns.

16. The electric field in a linear dielectric medium is $E = 9 \cos (20z - 3 \times 10^9 t) \hat{x}$ V/m. Determine the electric displacement D and magnetic field B using Maxwell's equations. The medium has a relative permittivity of 3 and does not contain any free charges or free currents.

17. The electric field of an electromagnetic wave propagating along x direction in a medium is $E = 5 \cos (15x - 3 \times 10^9 t) \hat{J}$ V/m, where t and x are in seconds and metres respectively. Determine the velocity of electromagnetic wave and refractive index of the medium.

18. Calculate the reflection and transmission coefficients for normal incidence of electromagnetic waves on glass-air interface ($n_1 = 1.5$ and $n_2 = 1.0$).

19. In the diagram the battery emfs. are 6 V and 12 V, their internal resistances 0.5 ohm and 1 ohm. The values of other resistances are as indicated in ohm. Find the current flowing in the branch AB by superposition theorem.



20. An AC supply of rms value 230 V, 50 Hz is applied to a series RC circuit containing a capacitor of 5 μF and a resistor of 1000 Ω. Calculate the average power consumed by the circuit. **(4×3=12)**

SECTION – D **(10 Marks)**

Long essay. **Four** questions. Answer **any two** questions. **Each** question carries **5** marks.

21. Discuss the various charge and current densities in matter and derive Maxwell's equations in matter.

22. Explain energy density, momentum density, pointing vector, intensity and radiation pressure associated with uniform plane monochromatic electromagnetic waves.

23. State Norton's theorem and explain with a sample diagram how a circuit can be nortonized.

24. An AC voltage is applied to a circuit containing inductance L, capacitance C and resistance R in series. With the help of a neat diagram, derive the expression for the impedance of the circuit and obtain the equation for resonant frequency.

(2×5=10)

K24U 0072

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree (C.B.C.S.S.-OBE – Regular/ Supplementary/Improvement) Examination, April 2024

(2019 to 2021 Admissions)

CORE COURSE IN PHYSICS

6B12 PHY : Nuclear, Particle and Astrophysics

Time : 3 Hours Max. Marks : 40

SECTION – A

Answer **all** questions. **Each** carries **1** mark.

1. When the mass of an electron, proton and neutron are m_e, m_p and m_n respectively, then the nuclear mass of an atom ${}_ZX^A$ is _____
2. _____ type of nuclear reaction is responsible for liberation of energy in the nuclear reactor.
3. Strontium-90 is used for the treatment of _____
4. The spin of the quark is _____
5. The colour of a star is a measure of its _____
6. The brightest star in the night sky is _____ **(6×1=6)**

SECTION – B

Answer **any six**. **Each** carries **2** marks.

7. Explain the term mass defect.
8. Define Q value of a nuclear reaction.
9. Write a note on ${}^{235}_{92}U$ chain reaction.
10. What is Mossbauer effect ?

P.T.O.

11. What are Leptons ? Name them.

12. What is the concept of quark model ? What are the properties ?

13. What is cosmology in astronomy ?

14. How is a star born ? Explain. **(6×2=12)**

SECTION – C

Answer **any four**. **Each** carries **3** marks.

15. Find the density of the $^{12}C_6$ nucleus.

16. Calculate the energy released by fission of 1 kg of U^{235} in KWH. The energy released per fission is 200 MeV and avagadro number is 6.023×10^{23}.

17. If a star's surface temperature is 30,000 K, how much power does a square meter of its surface radiate.

18. Briefly explain about neutron stars.

19. Write a note on stellar winds.

20. Obtain an expression for internal temperature of a star. **(4×3=12)**

SECTION – D

Answer **any two**. **Each** carries **5** marks.

21. State the law of radioactive decay. Drive an expression for it.

22. Briefly explain the fusion process in stars.

23. Explain the conservation laws in elementary particles.

24. What is Hertzsprung Russell diagram ? Discuss stellar mass and stellar radius. **(2×5=10)**

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K23U 0527

Reg. No. : .....

Name : .....

VI Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, April 2023
(2019 and 2020 Admissions)
Core Course in Physics
6B12 PHY – NUCLEAR, PARTICLE AND ASTROPHYSICS

Time : 3 Hours Max. Marks : 40

SECTION – A

Answer **all** questions. **Each** carries **1** mark.

1. Give the dimension and unit of nuclear cross section.
2. A star at a distance of 100 parsec has a parallax of _____ arcseconds.
3. Particles with integral spin are called _____
4. Quark model of neutron is _____
5. Which nucleus has highest binding energy per nucleon ?
6. Give an example for strong force. **(6×1=6)**

SECTION – B

Answer **any six** questions. **Each** carries **2** marks.

7. What is meant by the Astronomical Unit ? Which are the most commonly used units of stellar distance ?
8. Briefly explain Wein's displacement law.
9. What are resonant particles ? Give example.

P.T.O.

10. What are called white dwarfs ?

11. What are called main sequence stars ? Give example.

12. Write a short note on the inertial confinement in fusion reactor.

13. What is meant by neutron activation analysis ? Give its application.

14. Which are conservation laws in radioactive decay ? **(6×2=12)**

SECTION – C

Answer **any four** questions. **Each** carries **3** marks.

15. Find the kinetic energy of the alpha particle emitted in the alpha decay process $Ra^{226} \rightarrow Rn^{222} + He^{4}$.

    Mass of Ra^{226} = 226.025410, Mass of Rn^{222} = 222.017578, Mass of He^{4} = 4.002603

16. The half-life of $_{198}Au$ is 2.70 days.
    a) What is the decay constant of $_{198}Au$?
    b) What is the probability that any $_{198}Au$ nucleus will decay in one second ?

17. Fill the missing particle in the following reactions :
    a) $^{4}He + {}^{14}N \rightarrow {}^{17}O +$ _____
    b) $^{9}Be + {}^{4}He \rightarrow {}^{12}C +$ _____
    c) $^{27}Al + {}^{4}He \rightarrow {}^{1}n +$ _____

18. Sirius A has a magnitude of – 1.44, while the Sun has a magnitude of – 26.8. Find the ratio of their brightness.

19. Star 1 is at half the distance of Star 2 and appears twice as bright. Compare their luminosities.

20. Find the total binding energy and also the average binding energy per nucleon for the nucleus $^{40}_{20}Ca$. Atomic mass of Ca = 39.962589u, mass of neutron = 1.008665u, mass of proton = 1.007825u. **(4×3=12)**

SECTION – D

Answer **any two** questions. **Each** carries **5** marks.

21. Explain how stars are grouped in Hertzprung Russel diagram. Discuss the mass variation of main sequence stars.

22. With the help of a neat diagram, explain the parts of a nuclear fission reactor. How is it used for the production of electrical power ?

23. Explain the Quark model of mesons and baryons with examples.

24. What is the binding energy curve ? Explain nuclear fission and nuclear fusion on the basis of binding energy curve. **(2×5=10)**

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K24U 0071

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree (C.B.C.S.S. – OBE – Regular/Supplementary/ Improvement) Examination, April 2024
(2019 to 2021 Admissions)
CORE COURSE IN PHYSICS
6B11PHY : Optics and Photonics

Time : 3 Hours Max. Marks : 40

SECTION – A

(Short answer six questions. Answer **all** questions. **Each** carries **1** mark.)

1. When white light is used in Newton rings experiment, then all fringes are _____.
2. In Fresnel diffraction, the incident wavefront is _____.
3. The intensity of the principal maxima for a grating of N slits is proportional to _____.
4. Light is polarised to the maximum, when it is incident on a glass surface at an angle of incidence _____.
5. The technique by which image is obtained from a hologram is called as _____.
6. LASER is a short form of _____. **(6×1=6)**

SECTION – B

(Short answer eight questions. Answer **any six**. **Each** carries **2** marks.)

7. What is fringe width ? Given an expression for fringe width.
8. Explain the phenomena of colour of thin film.

P.T.O.

9. Why diffraction is common in sound but not common in light ?

10. Define resolving power of a grating.

11. How a quarter wave plate is constructed ?

12. What is the importance of metastable state in the production of laser light ?

13. Distinguish between step index fibre and graded index fibre.

14. Explain the important properties of holograms. **(6×2=12)**

SECTION – C

(Problem six questions. Answer **any four**. **Each** carries **3** marks.)

15. Two waves having intensities in the ratio 1 : 9. Find the ratio of the intensity minimum to the maximum.

16. Find the half angular width of the central bright maximum in the Fraunhofer diffraction pattern of a slit of width 12×10^{-5} am when the slit is illuminated by monochromatic wavelength 6000 A.

17. What is the radius of first zone in a zone plate of focal length 20 cm for light of wavelength 5000 A ?

18. Calculate the thickness of the doubly refracting crystal required to introduce a path difference of $\frac{\lambda}{2}$ between the ordinary and extra ordinary ray when λ = 6000 A, μ_o = 1.55 and μ_e = 1.54.

19. A glass fibre is made with core glass of refractive index 1.55 and cladding is doped to give a refractive index 1.5. Calculate the numerical aperture, acceptance angle and the fractional index change.

20. In moving one mirror in a Michelson interferometer through a distance of 0.1474 mm, 500 fringes cross the centre of the field of view. What is the wavelength of light ? **(4×3=12)**

SECTION – D

(Long essay four questions. Answer **any two**. **Each** carries **5** marks.)

21. Describe the experimental setup for producing Newton's rings by reflected light. Explain how this method is used to measure the wavelength of monochromatic light.

22. Explain the Fresnel diffraction by a circular aperture.

23. How can plane polarized light be produced by reflection ? State Brewster's law. Show that reflected and refracted rays are at right angles during polarization by reflection.

24. What are Einstein's coefficients ? Derive a relation between them. **(2×5=10)**

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K23U 0526

Reg. No. : .....

Name : .....

VI Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, April 2023
(2019 and 2020 Admissions)
CORE COURSE IN PHYSICS
6B11PHY : Optics and Photonics

Time : 3 Hours Max. Marks : 40

SECTION – A

(Short answer **six** questions. Answer **all** questions. **Each** carries **1** mark.) **6**

1. The angle of biprism is _____
2. In Fraunhofer class of diffraction the source is _____ distance from the obstacle.
3. Phase difference between two successive Fresnel's half period zones is _____
4. In propagation of electromagnetic waves, the angle between the direction of propagation and plane of polarization is _____
5. A soap bubble appears multicoloured in white light due to _____
6. The interference in which there is an increase in amplitude and hence intensity is called _____

SECTION – B

(Short answer **eight** questions. Answer **any six**. **Each** carries **2** marks.) **12**

7. Draw the intensity distribution curve of interference pattern.
8. What are coherent sources ? How are they realized in practice ?
9. Compare a zone plate and a convex lens.
10. Explain the phenomenon of polarization by double refraction.

P.T.O.

11. What is metastable state ?

12. Distinguish between step index fibre and the graded index fibre.

13. Explain how image is constructed from hologram.

14. Discuss any two applications of holography.

SECTION – C

(Problem **six** questions. Answer **any four**. **Each** carries **3** marks.) **12**

15. In Youngs experiment, the interference pattern is found to have an intensity ratio between the bright and dark fringes as 9. What is the ratio of a) intensities and b) amplitudes of the two interfering waves.

16. Light of wavelength 588 nm is incident on a thin film of glass of μ =1.5 such that the angle of refraction in the plate is 60°. Calculate the smallest thickness of the plate which will make it dark by reflection.

17. A narrow slit is illuminated by a light of wavelength 640 nm is placed at a distance of 3 m from a straight edge. If the distance between the straight edge and the screen is 6 m. Calculate the distance between the first and fourth bands.

18. Calculate the thickness of double refracting plate capable of producing a path difference of $\lambda/4$ between extra ordinary and ordinary waves. Given λ = 589 nm μ_0=1.53, μ_e=1.54.

19. What is the numerical aperture of an optical fibre cable with a clad index of 1.378 and a core index of 1.546 ?

20. At what temperature are the rates of spontaneous and stimulated emission equal ? Assume λ = 5000Å.

SECTION – D

(Long essay **four** questions. Answer **any two**. **Each** carries **5** marks.) **10**

21. Explain the formation of Newton's rings. How can these be used to determine the wavelength of monochromatic light ?

22. Discuss the Fraunhofer diffraction pattern due to double slit in detail.

23. Explain the production and detection of elliptically polarized light.

24. Explain the principle and working of a He-ne laser.

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K24U 0070

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree (C.B.C.S.S. – OBE-Regular/Supplementary/ Improvement) Examination, April 2024
(2019 to 2021 Admissions)
CORE COURSE IN PHYSICS
6B 10 PHY : Solid State Physics and Spectroscopy

Time : 3 Hours Max. Marks : 40

SECTION – A **(6 Marks)**

(**Six** short answer questions. Answer **all** questions. **Each** question carries **one** mark).

1. Wavelength of X-ray diffraction is of the order of _____
2. The number of lattice points in a primitive cell are _____
3. Intrinsic semiconductors are those materials having an energy gap of the order of _____
4. The relation between transmittance (T) and absorbance (A) is _____
5. Infrared spectroscopy is concerned with _____ of molecules.
6. Raman effect is an optical analogue of _____

SECTION – B **(12 Marks)**

(**Eight** short answer type questions. Answer **any six** each question carries **two** marks).

7. What are crystalline and amorphous solids ? Give examples.
8. Write down Bragg's equation and explain their symbols.
9. Write a note on intrinsic semiconductors.
10. What is spectroscopy ?
11. What you mean by quantization of energy ?

P.T.O.

12. What is symmetric top molecule ? Give two examples.
13. Draw graphical representation of Morse function.
14. What is Raman Effect ?

SECTION – C **(12 Marks)**

(**Six** problem questions. Answer **any four. Each** question carries **three** marks).

15. Deduce the packing factor for body centred cubic structure.
16. An intrinsic germanium semiconductor has a charge density of 2.4×10^{19} charges per m^3 at 300 K. The material is made extrinsic with an indium p impurity at the rate of one indium atom per 4×10^8 germanium atoms. If there are 4.4×10^{28} germanium atoms per m^3, determine the concentration of minority charge carrier and discuss the result.
17. Deduce the relation between the density of crystal material and lattice constant in a cubic lattice.
18. What is the change in rotational constant B when hydrogen is replaced by deuterium in hydrogen molecule ?
19. The fundamental and first overtone transitions of $^{14}N^{16}O$ are centred at 1876.06 cm^{-1} and 3724.20 cm^{-1} respectively. Evaluate the equilibrium vibration frequency, the anharmonicity and the exact zero point energy.
20. The vibrational wave numbers of the following molecules in their v = 0 states are HCl : 2885 cm^{-1}, DCl:1990 cm^{-1} and HD:3627 cm^{-1}. Calculate the energy change in kJ mol^{-1} of the reaction.

SECTION – D **(10 Marks)**

(**Four** long essay questions. Answer **any two. Each** question carries **five** marks).

21. Describe Bragg's X-Ray spectrometer and explain how it is used to determine the wavelength of X-Rays.
22. Obtain an expression for the rotational energy levels of a diatomic molecule taking it as a rigid rotator.
23. Explain mobility of charge carriers in semi conductors.
24. Discuss the spectrum of a diatomic vibrating rotator.

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K23U 0525

Reg. No. : .....

Name : .....

VI Semester B.Sc. Degree (CBCSS-OBE-Regular/Supplementary/ Improvement) Examination, April 2023
(2019 and 2020 Admissions)
CORE COURSE IN PHYSICS
6B10PHY : Solid State Physics and Spectroscopy

Time : 3 Hours Max. Marks : 40

SECTION – A
(6 Marks)

Short answer **six** questions. Answer **all** questions. **Each** question carries **1** mark.

1. The numbers of lattice points in a primitive cell are _____
2. The numbers of tetrad axes of symmetry elements that are present in a cubic crystal are _____
3. The majority charge carriers in N type semiconductor are _____
4. When a molecule has all three moments of inertia identical, it is called a _____ molecule.
5. The vibrational spectrum lies in _____ region of the electromagnetic spectrum.
6. For Raman scattering, a molecular rotation or vibration must cause some change in component of _____

SECTION – B
(12 Marks)

Short answer eight questions. Answer **any six**. **Each** question carries **2** marks.

7. What are Bravais lattices ?
8. What is coordination number ? Write the coordination number for sc, bcc and fcc lattices.
9. What are Miller indices ? Determine the Miller indices of plane of intercepts on X, Y and Z axis are ½ a, 2a, – 2a.
10. Explain the effect of temperature on mobility of charge carriers.
11. What is the principle of microwave oven ?

12. Write the expression for Morse function. Draw the Morse curve and the energy levels of a diatomic molecule.
13. What are overtone transitions in infrared spectroscopy ?
14. Distinguish between stokes lines and anti-stokes lines.

SECTION – C
(12 Marks)

Problem six questions. Answer **any four**. **Each** question carries **3** marks.

15. Deduce the relation between the density of crystal material and lattice constant in a cubic lattice.
16. Calculate the axial ratio for HCP.
17. In a P type semiconductor, the Fermi level lies 0.4 eV above the valence band. If the concentration of the acceptor atom is tripled, find the new position of the Fermi level.
18. The Hall coefficient of a certain silicon specimen was found to be $-7.35 \times 10^{-5} m^3 C^{-1}$ from 100 to 400 K. Further the electrical conductivity was found to be 200 $\Omega^{-1} m^{-1}$. Determine the nature of the semiconductor. Calculate the density and mobility of charge carriers.
19. The first line in the rotational spectrum of carbon monoxide has a frequency of $3.8424 cm^{-1}$. Calculate the rotational constant and hence the C–O bond length in Carbon monoxide. Avogadro number 6.022×10^{23}/mol.
20. The frequency of OH vibration in CH_3OH is $3300 cm^{-1}$. Estimate the frequency of OD stretching vibration in CH_3OD.

SECTION – D
(10 Marks)

Long essay four questions. Answer **any two**. **Each** question carries **5** marks.

21. Describe Bragg's x ray spectrometer and explain how it is used to determine the wavelength of x rays.
22. What are intrinsic and extrinsic semiconductors ? Discuss the location of Fermi levels under suitable limiting conditions.
23. Explain :
    i) Intensity of spectral line
    ii) Effect of isotopic substitution on the rotational spectra of rigid diatomic molecule.
24. Discuss the spectrum of a diatomic vibrating rotator.

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