44225/E0450

Reg. No. | | | | | | | | |

V Semester B.Sc. 5 (CBCS) Degree Examination, March/April - 2023

PHYSICS - I

Mathematical and Nuclear Physics

(Regular)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1) Calculators are allowed.
2) Write intermediate steps.

Part - I

Answer any Ten questions. **(10×2=20)**

1. a) Mention the orthogonality condition of cosine functions.

b) State Laplace Transform of a function.

c) Find the Laplace Transform of $f(t) = e^{at}$.

d) What is dead time of G.M. Counter?

e) State Geiger- Nuttal law of α-decay.

f) Write any two uses of cyclotron.

g) Explain α-decay with an example.

h) What is constraint? Give one example.

i) What are degrees of freedom? Mention it's equation.

j) State D 'Alembert's principle.

k) Complete the following reaction.

i) $_4Be^9 + ... \rightarrow _6C^{12} + _0n^1$

ii) $_7N^{14} + _2He^4 \rightarrow ..... + _1H^1$

l) The half life of a radioactive element is 4×10^8 years calculate decay constant.

[P.T.O.

Part - II

Answer question number 2 or question number 3.

2. a) Derive the equations for Fourier coefficients a_0, a_n, b_n. **(10)**

   b) Find the Fourier series representing

   $f(x) = x,\ 0 < x < 2\pi \text{ or } -\pi < x < \pi$ **(5)**

3. a) i) Derive Laplace transform of derivative of order n

   ii) Write the differences between Laplace and Fourier Transform. **(10)**

   b) Find the Laplace Transform of $\sin^2 t$. **(5)**

Part - III

Answer question number 4 or question number 5.

4. a) Explain the theory of successive disintegration and arrive at Bateman equation. **(10)**

   b) Calculate the half-life and mean life of a radioactive element. Given decay constant is $6\times10^{-4} S^{-1}$ **(5)**

5. a) Describe the construction and working of a linear accelerator. Show that the length of the cylinders are in the ratio of $l_1 : l_2 : l_3 .... :: 1 : \sqrt{2} : \sqrt{3} .....$ **(10)**

   b) Calculate the frequency of oscillating potential applied to a cyclotron so as to accelerate deuteron using magnetic field of 2.5T. Given

   Mass of deuteron = 3.34×10^{-27} kg.

   Charge of deuteron = 1.6×10^{-19}C **(5)**

Part - IV

Answer question number 6 or question number 7.

6. a) Derive an expression for the Q-value of nuclear reaction in terms of mass. K.E. of incident particle and product particle. **(10)**

   b) Calculate the energy released (Q-value) in the following reaction.

   ${}_3Li^6 + {}_1H^2 \rightarrow {}_2He^4 + {}_2He^4 + Q$. The atomic masses are

   ${}_1H^2 = 2.0141024$, ${}_3Li^6 = 6.0151234$ and ${}_2He^4 = 4.0026034$. **(5)**

7. a) Explain the types of Nuclear reactions with examples. (10)

b) Complete the following reactions. (5)

i) ${}_1H^2 + {}_8O^{16} \rightarrow {}_7N^{14} + ...$

ii) ${}_2He^4 + {}_3Li^6 \rightarrow {}_5B^9 + ...$

iii) ${}_6C^{12} + {}_0n^1 \rightarrow {}_6C^{11} + ...$

iv) ${}_7N^{15} \rightarrow {}_8O^{15} + ...$

v) ${}_{92}U^{239} \rightarrow ..... + {}_2He^4$

Part - V

Answer question number 8 or question number 9

8. a) Derive Lagrange's equation of motion from D'Alember's principle. (10)

b) Arrive as equation of motion for simple pendulum using Lagrangian formulation. (5)

9. a) Derive an expression for Lagrange's equation from Hamilton's principle. (10)

b) State and prove law of conservation of energy. (5)

42542/E420

Reg. No. | | | | | | | | |

V Semester B.Sc.4. Degree Examination, March/April - 2023

PHYSICS (OPTIONAL)

Paper - I

(Repeater)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates : *1. Simple calculators are allowed.*
2. Write intermediate steps.

Part - I

1. Answer any **Ten** of the following. **(10×2=20)**

a. What are constraints? Give examples.

b. Define degrees of freedom.

c. What is central force?

d. What are dangling bonds?

e. What is time dilation?

f. How mass varies with velocity according to relativistic mechanics?

g. State Norton's theorem.

h. Draw circuit symbols of n and p channel FET.

i. What is ripple factor of a rectifier circuit?

j. Find the peak value of voltage across the secondary winding if load resistance of centre tap full wave rectifier is 3000 Ω, peak current is 0.1 A and forward bias dynamic resistance is 5 Ω.

k. The amplification factor of FET is 4.5. Calculate the mutual conductance, if the drain resistance is 2.5 kΩ.

l. What is positive feedback?

[P.T.O.

Part - II

Answer any **Four** questions. Each question carries **5** marks. **(4×5=20)**

2. State and derive kepler's third law of planetary motion.
3. Derive Einstein's mass energy relation.
4. Explain with neat circuit diagram, the working of full wave bridge rectifier.
5. The period of earth is 365.25 days and that of venus is 224.7 days. Find the ratio of major axis of their orbits.
6. Applied input AC power to a half wave rectifier is 200 watts, if rectification efficiency is 37%, find the dc output power.
7. A Hartley oscillator has a capacitor of 250 pF and inductance of each part of inductance coil is 15 mH. calculate the frequency of the oscillator neglecting the mutual inductance between the two coil.

Part - III

Answer any **Four** of the following, each question carries **10** marks. **(4×10=40)**

8. What are generalised co-ordinates? Obtain expression for generalised kinetic energy.
9. Reduce two body central force problem to an equivalent one body problem.
10. Describe Michelson - Morley experiment to detect motion of earth through ether.
11. a. What are voltage and current sources? Explain.

    b. State and prove superposition theorem.
12. Explain the working of FET with neat diagram. Define FET parameters and obtain the relation between them.

44226/E0460

Reg. No. | | | | | | | | | |

V Semester B.Sc 5 (CBCS) Degree Examination, April - 2023

PHYSICS OPTIONAL

Quantum Mechanics-I Electronics and Optoelectronics

Paper : II A

(Regular)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

Calculators allowed to solve problems, write the intermediate steps.

I. Answer any **ten** of the following questions. **(10×2=20)**

1. a) What are matter waves and write the expression for de broglie wavelength.

   b) Define group velocity and phase velocity.

   c) Draw the symbol of zener diode and photo diode.

   d) Write down barkhausen criterion for oscillator.

   e) What are 'h' parameter and mention their units.

   f) Draw the symbol of FET and Transistor .

   g) Write down the truth table of NAND gate.

   h) Define dark current.

   i) If rating mention in zener diode are v_z=7.2v and p_z=0.25 watts calculate zener current I_z.

   j) The value of trans conductance and drain resistance of FED are $g_m = 0.5\times10^{-3}\Omega^{-1}$ and $r_d = 2.5\times10^{3}\Omega$ calculate amplification factor.

   k) Mention the factor on which transmission loss depends on.

II. Answer any **one** of the following (question 2 or question 3)

2. a) Derive the expression for wavelength of de broglie's wave, write expression of wavelength in terms of temperature, momentum and energy. **(10)**

   b) Calculate the wavelength of electron having energy 40 Kev. **(5)**

P.T.O.

3. a) State and explain uncertainity principle with illustration. **(10)**

   b) A photon having energy 10ev is incident on photoemissive surface of work function 6ev, find the velocity of ejected electrons. **(5)**

III. Answer any **one** of the following (question 4 or question 5)

4. a) Mention the difference between conductor, insulator, and semiconductor on the basis of band theory of solids, and explain the concept of effective mass and hole. **(10)**

   b) Find the range of input voltage to maintain 30 volts across the load resistance of $2k\Omega$, Given $Rs = 200\Omega$ and $I_z = 25MA$ **(5)**

5. a) Explain How zener diode acts as regulator with a neat diagram. **(10)**

   b) Electron and hole mobilities of as sample are 0.135 m^2/v-s and 0.04 m^2/v-s respectively determine conductivity and resistivity at 300°k, If the intrinsic concentration is 1.5×10^{16} atms/m^3. **(5)**

IV. Answer any **one** of the following (question 6 or question 7)

6. a) What is FET? Mention the types of FET, Explain the experiment to determine parameters of FET. **(10)**

   b) P.T. $A + \overline{A}B = A + B$. **(5)**

7. a) Explain the construction and working of Hartley Oscillator. **(10)**

   b) In Case of phase shift oscillator with Op Amp R=56 $k\Omega$ and C=.5nF calculate the frequency of oscillator **(5)**

V. Answer any **one** of the following (question 8 or question 9)

8. a) Explain the construction and working of photo diode. **(10)**

   b) Calculate the critical angle and Numerical aperture for an optical fiber where $n_{core} = 1.5$ $n_{clad} = 1.45$ **(5)**

9. a) Mention the difference between step index and graded index optical fiber, also mention advantages of optical fiber. **(10)**

   b) Explain in brief opto couplers. **(5)**

42543/E430

Reg. No. | | | | | | | | |

V Semester B.Sc.4. Degree Examination, April - 2023
PHYSICS (OPTIONAL) - II
(Repeaters)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates : *Calculators are allowed for calculations, write the intermediate steps.*

PART - A

1. Answer any **Ten** of the followings. **(10×2=20)**

a. Write the expression for compton shift.

b. What are metastable states in atom.

c. State the orthogonal condition for wave functions.

d. State Carmers theorem.

e. What is orbital quantum number.

f. On what factor does the normal zoeman shift depends on.

g. Mention the types of molecular spectrum.

h. Show that $P_n(1) = 0$.

i. What are stokes and anti stokes lines.

j. Uncertainity in position of electron is 4×10^{-10} m, calculate the uncertainity in momentum.

k. Write Hermite differential equation.

l. Calculate in teratomic distance for a molecule where $\mu = 1.6\times10^{-27}$ kg $I = 4\times10^{-47}$ kg-m^2.

PART - B

Answer any **Four** of the following questions each carries **5** marks. **(4×5=20)**

2. Illustrate uncertainty principle with electron diffraction.

[P.T.O.

3. Explain the physical significance of wave function.

4. Mention the difference between Normal and anamalous Zeeman effect.

5. Show that $\int_{-1}^{1} xP_n(x)\,P_{n-1}(x)dx = \frac{2n}{4n^{2-1}}$.

6. An electron is confined to one dimension box of length $2A^{o}$, Calculate lowest energy state of the system.

7. Calculate Zeeman shift observed in a spectral line of wavelength 600 nm is subjected to field of 2T and Given e = 1.6×10^{-19} J, m = 9.1×10^{-37} kg.

PART - C

Answer any **Four** of the following. **(4×10=40)**

8. Derive the expression for compton shift.

9. With neat diagram explain the construction working of He-Ne laser.

10. Explain the experimental setup used to study the Raman Effect.

11. Obtain the expression for energy of electron (particle) confined to one dimensional box.

12. Derive the orthogonality of Bessel's functions.

44248/E5080

Reg. No. | | | | | | | | |

V Semester B.Sc. 5 Degree Examination, March/April - 2023

MATHEMATICS(SEC)

Number theory

(Regular)

Time : 2 Hours **Maximum Marks : 40**

Instructions to Candidates :

1) Question paper containing two parts A and B.
2) Answer all parts.

Part - A

Answer any **five** of the following. **(5×2=10)**

1. a) Define greatest common divisor.

   b) If a/bc and (a,b) = 1 , then prove that a/c.

   c) Define bracket function.

   d) State Euler's theorem of relative prime numbers.

   e) Find the number of positive integers ≤ 2205 that are relatively prime to 2205.

   f) If (P,7) = 1, then prove that P^{12}-1 is divisible by 7.

   g) State Fermat's theorem of prime numbers.

Part - B

Answer any **six** of the following. **(6×5=30)**

2. Prove that for any two integers a and b, then there exist a unique numbers g and r such that $a = bg + r$ where $0 \leq r < b$.

3. Find the Greatest common Divisor of 275 and 726, also express it in the form of 275m+726n.

4. Prove that $9^n - 8^n - 1$ is divisible by 8.

[P.T.O.

5. State and prove Fundamental theorem of Arithmetic.

6. Find the number of divisors and sum of divisors of 360.

7. State and prove Wilson's theorem of prime numbers.

8. If m and n are relatively prime to 133, then prove that $m^{18} - n^{18}$ is divisible by 133.

9. Prove that 12!+ 209 is divisible by 221.

44223/E0430

Reg. No. | | | | | | | | |

V Semester B.Sc. 5 Degree Examination, March/April - 2023

MATHEMATICS - II A

Numerical Analysis and Difference Equation

Paper : II

(Regular w.e.f. 2022-23)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1) Answer All questions.
2) Students are allowed to use scientific calculators.

PART - A

Answer any **TEN** of the following questions. **(10×2=20)**

1. a) Explain briefly iteration method to find the real root of $f(x)=0$

b) Find the real root of $x^3-x-1=0$ using bisection method in two stages.

c) With usual notation, prove that $\Delta E = E\Delta$.

d) If $u_0=3, u_1=12, u_2=81, u_3=200, u_4=100, u_5=8$ find $\Delta^5 u_0$.

e) Evaluate $\Delta^{10}\left[(1-x)(1-2x^2)(1-3x^3)(1-4x^4)\right]$ by taking h = 1

f) Write the formula to find the second derivative using forward difference.

g) State 'Trapezoidal rule' to evaluate $\int_a^b f(x)dx$

h) From the Taylor's series for y(x), find y at $x=0.1$, correct to 4 decimal places, if $y(x)$ satisfies $y'=x-y^2$ with $y(0)=1$

i) Explain Euler's method to solve $\frac{dy}{dx}=f(x,y)$ with initial condition $y(x_0)=y_0$

j) Find the order and degree of the difference equation $y_{n+3}-8y_{n+1}-15y_n=5x-2$.

k) Form the difference equation by eliminating a and b from the relation $y_x=a.2^x+b.3^x$.

l) Write the formula for second order Runge-Kutta method.

[P.T.O.

PART - B

Answer any **FOUR** of the following questions. **(4×5=20)**

2. Explain the Gauss-Seidel method to solve the equations: $a_1x+b_1y+c_1z=d_1$, $a_2x+b_2y+c_2z=d_2$, $a_3x+b_3y+c_3z=d_3$.

3. Express the function $f(x)=x^4-12x^3+24x^2-30x+9$ and its successive differences in a factorial notations, when h = 1.

4. State and prove Newton-Gregory backward interpolation formula.

5. Evaluate $\int_0^1 \frac{x}{1+x^2}dx$ using Simpson's $\left(\frac{3}{8}\right)^{th}$ rule with h = 0.2 and hence obtain the approximate value of $\log(\sqrt{2})$

6. Using Euler's method to compute y for $x=0.05$ and $x=0.1$, given that $\frac{dy}{dx}=x+y$ with the initial condition $x_0=0, y_0=1$.

7. Solve $y_{n+2}-4y_{n+1}+3y_n=5^n$.

PART - C

Answer any **FOUR** of the following questions. **(4×10=40)**

8. a) Derive the Newton-Raphson formula $x_{n+1}=x_n-\frac{f(x_n)}{f'(x_n)}.n=0,1,2,3.....$

   b) Find the real root of $x^3-3x-5=0$ in the interval $(2,2.5)$, Correct to three decimal places using Bisection method.

9. a) State and prove 'Lagrange's interpolation formula for unequal intervals.

   b) Find the number of students from the following data who secured marks not more than 45

Marks	30-40	40-50	50-60	60-70	70-80
No.of. Students	35	48	70	40	22

10. a) State and prove 'General Quadrature formula for equidistant ordinates.

b) Find $f'(1.2)$ and $f''(1.2)$ from the following data.

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
f(x)	2.72	3.32	4.06	4.96	6.05	7.39	9.02

11. a) Explain Picards method to solve the equation $\frac{dy}{dx} = f(x, y)$ with initial condition $y(x_0) = y_0$.

b) Using Runge-Kutta method of second order, find $y(1.4)$, given that $\frac{dy}{dx} = xy$ with $y(1) = 2$ by taking h = 0.2.

12. a) Solve $y_{x+2} - 2y_{x+1} + y_x = x^2.2^x$

b) Find the solution of the difference equation $y_{x+2} - 7y_{x+1} + 12y_x = \cos x$.

42538/E380

Reg. No. | | | | | | | | |

V Semester B.Sc.4 Degree Examination, March/April - 2023

MATHEMATICS

Numerical Analysis Difference Equation

Paper - II

(Repeater)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates : *1. Answer **all** questions.*
2. Students are allowed to use scientific calculators.

Part - A

I. Answer any **Ten** of the following. (2 marks each). **(10×2=20)**

1. a. Find the real root of $x^3 - 2x - 5 = 0$ in [2,3] by bisection method in two stages.
   b. Explain briefly Iteration method to find the real root of f(x) = 0.
   c. With usual notation prove that $E\Delta = \Delta E$.
   d. If $u_0 = 1$, $u_1 = 11, u_2 = 21, u_3 = 28, u_4 = 29$, find $\Delta^4 u_0$.
   e. Evaluate $\Delta^3(1+4x)(1+6x)(1+8x)$ where n = 1.
   f. Write the formula for finding first derivative using forward difference.
   g. From the Taylor's series for y(x), find 'y' at x = 0.1, correct to 3 decimal places if y(x) satisfies $y' = x - y^2$ and y(0) = 1.
   h. Explain Euler's method to solve $\frac{dy}{dx} = f(xy)$ with intial condition $y(x_0) = y_0$.
   i. Find the order and degree of the difference equation $y_{n+3} - 3y_{n+2} + 6y_{n+1} - 4y_n = 1$.
   j. From the difference equation by eliminating a and b from the relation $y_x = a3^x + b(-3)^x$.
   k. Write the formula for second order Runge - Kutta method.
   l. Solve $u_{x+2} - 25u_{x+1} + 46u_x = 0$ by method of differences.

Part - B

II. Answer any **Four** of the following. **(4×5=20)**

2. Solve by Gauss - seidal iteration method. Carry out 4 iterations.
   $28x + 4y - z = 82$, $x + 3y + 10z = 24$, $2x + 17y + 4z = 35$.

[P.T.O.

3. Express $f(x)=11x^4+5x^3+2x^2+x+15$ and its successive differences in a factorial notation h = 1.
4. State and prove Newton - Gregory forward inter polation formula.
5. Evaluate $\int_4^{5.2}\log x\,dx$ by using simpson's $\left(\frac{3}{8}\right)^{th}$ rule.
6. Determine the value of Y when $x = 0.1$ given that y(0) = 1, $\frac{dy}{dx}=\frac{y-x}{y+x}$ using Euler's modified method.
7. Solve $y_{x+2}-4y_{x+1}+4y_x=ax+b$.

Part - C

III Answer any **Four** of the following. **(4×10=40)**

8. a. Derive the Newton-Raphson formula, $x_{i+1}=x_i-f(x_i)/f'(x_i)$
   b. Estimate the missing term in the following table.

x	0	1	2	3	4	5
y	0	-	8	15	-	35

9. a. Prove that the nth difference of a polynomial of degree 'n' is a constant proportional to 'n' and higher order differences are zero.
   b. Find the polynomial of 3rd degree which takes the following values.

x	3	4	5	6	7
f(x)	6	24	60	120	210

10. a. State and prove lagrange's interpolation formula for unequal intervals.
    b. Find $f'(0.4)$ and $f''(0.4)$ from the following table.

x	0.1	0.2	0.3	0.4
f(x)	1.10517	1.22140	1.34986	1.49182

11. a. Explain picards method to solve the equation $\frac{dy}{dx}=f(x,y)$ with initial condition $y(x_0)=y_0$.
    b. Using Runge - Kutta method of order 2. Find y(0.2), given that $\frac{dy}{dx}=\frac{y^2+x^2}{10}$, y(0)=1 take h=0.1
12. a. Solve the equation $u_{x+2}-7u_{x+1}+10u_x=4^x$.
    b. Solve $y_{x+2}-10y_{x+1}+25y_x=0$ by the method of differences using y(0) = 1 and y(1)=0.

42539/E390

Reg. No. | | | | | | | | | |

V Semester B.Sc.4 Degree Examination, March/April - 2023

MATHEMATICS

Dynamics & Calculus of Variation

Paper - III

(Repeaters)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates : *1. Answer all questions.*
2. Question paper has three parts namely A, B and C.

Part - A

I. Answer any **Ten** of the following. **(10×2=20)**

1. a. If the tangential & normal accelerations are equal then prove that the velocity is propotional to e^{ψ}.

   b. If the angular velocity of the moving point about a fixed origin be constant. Show that its transverse acceleration is varies as radial velocity.

   c. Define :

      i. Central orbit.

      ii. Central force.

   d. Find the law of force if central orbit is $\frac{b^2}{p^2}=\frac{2a}{r}-1$.

   e. Prove that an apse $\frac{dr}{d\theta}=0$.

   f. Define horizontal range. Show that maximum horizontal range is $\frac{u^2}{g}$.

   g. Define time of flight and show that time taken for the particle is $\frac{2u\sin\alpha}{g}$.

   h. State Newton's experimental law for oblique impact.

[P.T.O.

i. Find the solution of Euler's equation when f is independent of x.

j. State Brachistochrone problem.

k. Define geodesic and what is geodesic on a plane.

l. Define Isoperimetric problem.

Part - B

II. Answer any **Four** of the following. **(4×5=20)**

2. Show that the intrinsic equation of the path is $s = ae^{\psi} + B$, also show that the resultant velocity varies as e^{ψ}.

3. A particle describes a curves $r = e^{\theta}$ with constant angular velocity, show that radial acceleration is zero and transverse acceleration varies as its distance from the pole.

4. If the central orbit is $r^n = a^n \cos n\theta$ under the force towards the pole then find the law of force.

5. Derive the expressions for the loss of kinetic energy due to the direct impact.

6. Find curve on which functional $I = \int_0^1 \left[\left(\frac{dy}{dx} \right)^2 + 12xy \right] dx$ with $y(0) = 0$ and $y(1) = 1$ can be extremed.

7. Prove that the catenary is a curve which, when rotated about a line generates a surface of minimum area.

Part - C

III. Answer any **four** of the following. **(4×10=40)**

8. a. A particle describes a plane curve of the tangential and normal accelerations are each constant at any point. Prove that the angle through which the direction of motion turns in time t is given by $\psi = A\log(1 + Bt)$.

   b. Derive the expressions for the radial and transverse component of acceleration of particle moving along a plane curve.

9. a. With usual notations prove that $F = h^2u^2\left[u + \frac{d^2u}{d\theta^2}\right]$.

   b. If the path of central force varies inversely as the square of the distance from a fixed point, find the orbit.

10. a. A particle is projected in a direction making an angle θ with the horizontal, if it passes through the points (x_1, y_1) and (x_2, y_2) referred to the horizontal and verticle axes through the point of projection then prove that $\tan\theta = \frac{x_2^2 y_1 - x_1^2 y_2}{x_1 x_2 (x_2 - x_1)}$.

b. A sphere impinge directly on an equal sphere which is at rest, prove that a fraction $\frac{1}{2}(1-e^2)$ times the original kinetic energy is lost during the impact.

11. a. State and prove necessary condition of Eulers equation.

b. Find the curve on which the functional $\int_0^{\pi/2} (y'^2 - y^2 + 2xy)\,dx$ with $y(0) = 0$ and $y(\pi/2) = 0$ can be extremised.

12. a. Show that geodesic in an Euclidean plane is a straight line.

b. Find the extremum of the functional $I = \int_0^{\pi} (y_1^2 - y^2)\,dx$ under the conditions $y(0) = 0$, $y(\pi) = 1$ and subjected to the constraint $\int_0^{\pi} y.dx = 1$.

44207/E0270

Reg. No. | | | | | | | | |

V Semester B.Sc. 5 (CBCS) Degree Examination, April - 2023

CHEMISTRY (Optional)

Paper : I

(Regulars)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1. *All questions are compulsory.*
2. *Answer all questions in the same answer book.*
3. *Draw neat diagrams and give equations wherever necessary.*

I. Answer any Ten questions. **(10×2=20)**

1. What are bio inorganic nanomaterials?
2. Define coprecipitation.
3. Write Von - weimarn equation.
4. What is Eco - efficiency?
5. What are alkaloids?
6. Write the nitration reaction of furan.
7. Define zero point energy.
8. Calculate the number of vibrational modes in CO_2 molecules.
9. Give the statement of Hooks law.
10. Write the synthesis of polyvinyl chloride.
11. Write the structure of Novalac.
12. Define disconnection of pentanol.

II. Answer any Three questions. **(3×5=15)**

1. Discuss the different steps in gravimetric analysis.
2. Explain the formation of phosphonitrilic chloride.
3. Explain the one dimentional control of nanoarchitecture.
4. Explain the formation of silicones.

[P.T.O.

III. Answer any **Three** questions. (3×5=15)

1. Discuss the Hofmann exhaustive methylation of pyridine.
2. Write the principles of Green chemistry.
3. Discuss the structure of coniine.
4. Explain the comparitive basic character of pyrrole, Pyridine and piperidine.

IV. Answer any **Three** questions. (3×5=15)

1. Explain energy levels of a diatomic molecule (Rigid - Rotator).
2. The Rotational spectrum of HCl has lines spaced at 384.2 cm calculate moment of inertia and bond length. Given μ of $HCl = 1.626\times10^{-27} kg$, $h = 6.626\times10^{-34}$ Joules and C = 3×10^{8}m/s.
3. Explain qualitative relation between force constant and bond dissociation energy.
4. Determine the force constant for vibrational spectra.

V. Answer any **Three** questions. (3×5=15)

1. Give Retrosynthetic root for 4 - methoxyacetophenone.
2. Write a note on polyolefins.
3. Write the structure and conductivity of polypyrrole and polythiophene.
4. Explain thermal and mechanical properties of polystyrene.

42525/E250

Reg. No. | | | | | | | | |

V Semester B.Sc. 4 Degree Examination, April - 2023

CHEMISTRY (Optional)

Paper - I

(Repeater)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1. *All questions are compulsory.*
2. *Answer all questions in the same answer book.*
3. *Draw neat diagrams and give equations wherever necessary.*

SECTION - A

Answer any **Ten** of the following. **(10×2=20)**

1. a) What are silicones? Give it's general formula.

b) What is co-precipitation? How it is minimised?

c) Define hydrate isomerism. Give an example.

d) Write Von - weirmann equation.

e) How do you synthesis Barbituric acid from diethyl malonate?

f) Draw the molecular orbital picture of pyridine molecule.

g) Write the structure of coniine.

h) Write any two general properties of alkaloids.

i) Write the selection rule for rotational spectra.

j) Write Gibbs - phase rule equation. And explain the terms in it.

k) Calculate number of vibrational modes in CO_2 molecule.

l) What is triple point?

[P.T.O.

SECTION - B

Answer any **Four** of the following questions. **(4×5=20)**

2. Explain
   i. Hydrate isomerism and
   ii. Ionisation isomerism in coordination compounds with C.N.6.
3. Explain the steps involved in gravimetric analysis.
4. Write a note on ketoenol tautomerism.
5. Explain the acidity of α - hydrogenation in Ethyl Aceto Acetate (EAA).
6. Draw the phase diagram of sulphur system and discuss the application of phase rule.
7. The fundamental vibrational frequency of HCl is 2890 cm^{-1}. Calculate the force - constant of HCl molecule.

SECTION - C

Answer any **Four** of the following Questions. **(4×10=40)**

8. a) Explain any five principles of green chemistry.
   b) Explain geometrical isomerism and optical isomerism in coordination compounds with C.N.4.
9. a) Compare the basicities of pyridine, Piperidine and pyrrole.
   b) How do you synthesise.
      i. Dicarboxylic acid
      ii. Ketone from Ethyl Aceto Acetate (EAA).
10. a) Explain energy levels of diatomic molecule (rigid rotator).
    b) Give the synthesis of Nicotine.
11. a) Explain the structure of $[Fe(CN)_6]^{4-}$ on the bases of VBT.
    b) Give that the rotational spectrum of HCl has lines spaced at 384.2 cm apart. Calculate the moment of inertia and bond length of molecule $\mu = 1.627 \times 10^{-27}$ kg $h = 6.626 \times 10^{-34}$ joules.
12. a) Explain applications of phase - rule to KI-water system.
    b) How is force constant of a diatomic molecule related to it's vibrational frequency? Deduce the relationship.

42526/E260

Reg. No. | | | | | | | | |

V Semester B.Sc. Degree Examination, April - 2023

CHEMISTRY (Optional)

Paper - II

(Repeaters)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1. *All sections are compulsory.*
2. *Draw neat **diagrams** and give equations wherever necessary.*

SECTION - A

1. Answer any **TEN** questions. **(10×2=20)**

a. Mention the types of alloys with examples.

b. Write major raw materials used in the manufacture of glass.

c. Write the composition and use of Lithophone.

d. Write the characteristics of good fuels.

e. How NBS is prepared?

f. Write the structure and use of Osmium tetroxide (OsO_4)

g. Write two requirements of A dye.

h. Write the structure of fluorescein.

i. Write BET equation.

j. Write two industrial applications of catalysis.

k. State the law of mass action.

l. What is chain inhibition? Give example.

P.T.O.

SECTION - B

Answer any **FOUR** questions. **(4×5=20)**

2. What is Carborundum? How it is manufactured?
3. Write the composition and use of following.
   i. Pyrex glass.
   ii. Crooke's glass.
   iii. Flint glass.
4. What is base peak? Explain McLafferty rearrangement with respect to butyraldehyde.
5. Explain the mechanism of oxidation of 1,2 - diols using lead tetra acetate.
6. Derive Micheal's - Menten equation.
7. Derive the relation between K_p and K_x. When $K_p = K_c = K_x$.

SECTION - C

Answer any **FOUR** questions. **(4×10=40)**

8. a. Explain
      i. Setting of cement.
      ii. Moh's scale of hardness.
   b. How Biogas is manufactured? Mention its advantages.
9. a. Write the mechanism of formation of amide from carboxylic acid using DCC.
   b. Write the synthesis of following.
      i. Congo red.
      ii. Indigo.
10. a. Derive Langmuir adsorption isotherm.
    b. What is homogeneous catalysis? Explain the Intermediate compound formation theory of catalysis.
11. a. Write the synthesis of Alizarin.
    b. Derive Van't hoff reaction isotherm.
12. a. Explain the mechanism of Benzylic oxidation of titration to Naphthalene using DDQ.
    b. Discuss the steps involved in the chain reaction with example.