2025

Time :As in Programme

Full Marks : 25

The figures in the right-hand margin indicate marks.

*Answer **all** the questions*

PART-I

1. Answer all questions 1x5

ସମସ୍ତ ପ୍ରଶ୍ନର ଉତ୍ତର ଦିଅ ।

a. Education for character building.

ଚରିତ୍ର ଗଠନରେ ଶିକ୍ଷାର ଭୂମିକା ।

b. Ragging as a cause of mental trauma.

ରାଗିଂ ମାନସିକ ଆଘାତର ଏକ କାରଣ ।

c. Define plagiarism.

ପ୍ଲାଗିଆରିଜ୍ମର ସଂଜ୍ଞା ଲେଖ ।

d. What is Positive friendship ?

ସକାରାତ୍ମକ ବନ୍ଧୁତ୍ୱ କ'ଣ ?

e. Define co-curricular activities.

ସହଗ-ପାଠ୍ୟକ୍ରମର ସଂଜ୍ଞା ଲେଖ ।

PART-II

2. Answer any five of the following questions. 2x5

ନିମ୍ନଲିଖିତ ପ୍ରଶ୍ନଗୁଡ଼ିକ ମଧ୍ୟରୁ ଯେକୌଣସି ପାଞ୍ଚଟି ପ୍ରଶ୍ନର ଉତ୍ତର ଲେଖ ।

a. Explain, "Failed in examination but passed life".

"ପରୀକ୍ଷାରେ ଅକୃତକାର୍ଯ୍ୟ, ଜୀବନରେ କୃତକାର୍ଯ୍ୟ" - ବୁଝାଅ ।

b. What is cognitive-behavioural counselling ?

ଜ୍ଞାନାତ୍ମକ-ବ୍ୟାବହାରିକ ପରାମର୍ଶ କ'ଣ ?

(Turn Over)

c. Major conflicts among college students.

ମହାବିଦ୍ୟାଳୟ ଛାତ୍ରମାନଙ୍କର ପ୍ରମୁଖ ଦ୍ୱନ୍ଦ ।

d. Hostel life as independent but responsible.

ଛାତ୍ରାବାସ ଜୀବନ ସ୍ୱାଧୀନ କିନ୍ତୁ ଦାୟିତ୍ୱପୂର୍ଣ୍ଣ ।

e. Teacher-student relationship.

ଗୁରୁ-ଶିଷ୍ୟଙ୍କ ସମ୍ପର୍କ ।

f. Define leadership.

ନେତୃତ୍ୱର ସଂଜ୍ଞା ଲେଖ ।

g. Benefits of co-curricular activities for students.

ଛାତ୍ରମାନଙ୍କ ପାଇଁ ସହଗ-ପାଠ୍ୟକ୍ରମର ଉପାଦେୟତା ।

PART-III

3. Answer any two of the following questions. 5x2

ନିମ୍ନଲିଖିତ ପ୍ରଶ୍ନଗୁଡ଼ିକ ମଧ୍ୟରୁ ଯେକୌଣସି ଦୁଇଟି ପ୍ରଶ୍ନର ଉତ୍ତର ଦିଅ ।

a. "Knowledge is power" - Explain with examples.

"ଜ୍ଞାନ ହିଁ ଶକ୍ତି" - ଉଦାହରଣ ସହ ଆଲୋଚନା କର ।

b. "Violence vs. Peaceful protest" - Give your debate.

"ହିଂସା ବନାମ ଶାନ୍ତିପୂର୍ଣ୍ଣ ଓ ପ୍ରତିବାଦ" ବିତର୍କ ଲେଖ ।

c. "Cheating in examinations is cheating yourself". Explain.

"ପରୀକ୍ଷାରେ ଠକିବା ନିଜକୁ ଠକିବା ସହ ସମାନ" - ଆଲୋଚନା କର ।

d. "Positive interpersonal relation is the strength of life". Explain.

"ସକାରାତ୍ମକ ପାରସ୍ପରିକ ସମ୍ପର୍କ ଜୀବନର ଶକ୍ତି" - ଆଲୋଚନା କର ।

e. Describe scope of leadership for college students.

ମହାବିଦ୍ୟାଳୟ ଛାତ୍ରମାନଙ୍କର ନେତୃତ୍ୱ ନେବାର ସୁଯୋଗଗୁଡ଼ିକୁ ବର୍ଣ୍ଣନା କର ।

+3-IV-S-CBCS(MS)-Sc(H)-GE-2.2-Chem-R&B

2025

Time :As in Programme

Full Marks : 60

The figures in the right-hand margin indicate marks.

*Answer **all** questions.*

PART-I

1. Answer all Questions. 1x8

a. The heat of neutralisation of 1 mole of strong acid in dilute solution with one mole of strong base is ____.

b. What happens to the entropy of spontaneous process.

c. pH of pure water ____ with rise of temperature.

d. The solubility of CaF_2 is $3.2 \times 10^{-11} M^3$, its solubility is ____.

e. What is the product when benzene reacts with chlorine in the sun light ?

f. Phenol when heated with Zn produces ____.

g. What is the electrophile in Friedel Craft alkylation reaction ?

h. Which types of aldehyde undergo aldol condensation reaction ?

(Turn Over)

PART-II

2. Answer any eight within two to three sentences 1.5x8

   a. Define an isolated system ?

   b. What is Gibb's Helmholtz equation ?

   c. Explain why cloths dry quicker when there is breeze.

   d. Why pH of solution of potassium acetate is more than 7 ?

   e. Define solubility product.

   f. What is nitrating mixture ?

   g. Give one example each of o- &p- directing and m-directing group.

   h. Between benzene and toluene which is more reactive towards electrophilic substitution reaction and why ?

   i. How could you distinguish between Butan-2-one and butan-3-one ?

   j. Explain why boiling point of dimethyl ether is lower than that of ethyl alcohol.

PART-III

3. Answer any eight of the following (in maximum 75 words.) 2x8

   a. Calculate the heat of reaction of the following reaction.

$$CH_4(g) + 4F_2(g) \rightarrow CF_4(g) + 4HF(g)$$

Bond energy of C-H, F-F, C-F and H-F bonds are 415.5, 159.5, and 564.8 kj/mol respectively.

b. What would happen to a reversible reaction at equilibrium when

(i) Temperature is raised, given that its ΔH is +ve

(ii) Pressure is lowered given that Δn is +ve.

c. Why zinc sulphide is precipitated by H_2S from solution of zinc acetate but not solution of zinc chloride ?

d. What happens when HCl gas is passed through a saturated solution of barium chloride ?

e. Calculate the pH of 10^{-8} M HCl.

f. Write the mechanism of chlorination of benzene.

g. How can you prepare acetophenone from benzene ?

h. What is Fehling solution ? How does it react with aldehyde ?

i. How can you prepare benzaldehyde by Etard's reaction ?

j. Give the reaction of phenol with $CHCl_3$ in presence of aq.NaOH.

PART-IV

Answer within 500 words each. 6x4

4. State and explain Hess's law of constant heat summation. Discuss its application. 4+2

OR

Define Le Chatrlier's principle and how is it applied in manufacture of ammonia ? 2+4

5. What do you meant by Hydrolysis of salt ? Predict whether the aqueous solution of sodium carbonate will be acidic, neutral or alkaline, Explain why ? 2+4

OR

Write a note on buffer solution. A 0.1 MHCN solution contained 0.2 mole KCN per litre of solution. Calculate the $[H^+]$ of the solution (K_a of HCN = 7.2×10^{-10}) 4+2

6. a. How benzene is prepared from acetylene ? How does it reat with 2+2+2

(i) Cl_2 in presence of $AlCl_3$ (ii) Conc. H_2SO_4.

OR

b. Write notes on : (i) Sandmeyer's reaction (ii) Huckel's rule 4+2

7. How you can prepare acetaldehyde from ethyl alcohol ? What happens when acetaldehyde reacts with 2+2+2

a. CH_3MgBr (ii) H_2O/H^+

b. Phenyl Hydrazine ?

OR

How Primary, Secondary and Tertiary Alcohols can be distinguished by Lucas test ? What happens when excess of ethyl alcohol is heated with conc. H_2SO_4 at 140°C.

2025

Time :As in Programme

Full Marks : 60

The figures in the right-hand margin indicate marks.

*Answer **all** questions.*

PART-I

1. Answer all Questions. 1x8

   a. If 'x' is the true value and 'a' be an approximation to x then relative error is ____.

   b. Suppose the number 0.025 is approximated by 0.02. Find percentage error.

   c. In Gauss Jordan method system of equation AX=b reduces to DX=b where D is ____ matrix.

   d. Why Newton - Raphson method is superior to bisection method for finding the numerical solution of non linear equation ?

   e. The interpolating polynomial P(x) that interpolate $f(x)$ at $x_0, x_1 \ldots x_n$ is at most degree ____.

   f. Write the relation between forward difference operator and the shift operator.

   g. The mid point rule formula for $\int_a^b f(x)dx =$ ____.

   h. Write trapezoidal rule with error term.

(Turn Over)

PART-II

2. Answer any eight questions. 1.5x8

a. Round off the number 0.000455 correct upto three significant figures.

b. Find the interval in which the root of equation $x^2=3$ lies.

c. Write iteration function to find the root of the equation $x^3+x^2-1=0$ using fixed point iteration method.

d. Write the system of equation in AX=b form to find A, X and b :

e. Show that divided difference of a constant is zero.

f. Write Lagrange's Polynomial li(x) at (n+1) distinct points $x_0, x_1, \ldots x_n$ and write its properties.

g. What is the difference between Gaussian elimination method and Gauss. Jordan elimination method for solving system of linear equations ?

h. Write Newton cotes Quadrature formula involving (n+1) nodes $x_0, x_1, \ldots x_n$ with W_i $x_0 = x_0 + \alpha h$. $0 \leq \alpha \leq h$

i. Define extrapolation.

j. Write composite formula for Simpson's $\frac{1}{3}$ Rule $a=x_0<x_1 \ldots < x_{2n-1} < x_{2n} = b$ and it's error team.

PART-III

3. Answer any eight of the following questions. 2x8

a. Perform four iteration to find an approximation to $x^2=3$ using bisection method.

b. Using 5 - digits floating point arithmetic, find the product of $\frac{1}{3}$ and $\frac{5}{7}$.

Y5625

c. Derive formula for Newton Raphson method to find approximation to root of $f(x)=0$

d. Find the eigen values of $\begin{bmatrix} 1 & 2 & -2 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$.

e. Solve the equation by Gauss Jordan method, $x + y = 0$, $y+z = 1$, $x + z = 3$.

f. Is Pivoting always necessary for solving system of linear algebraic equations ? Justify your answer.

g. Show that $\mu^2 = 1 + \frac{\delta^2}{4}$.

h. Show that $\delta = \nabla(1-\nabla)^{-\frac{1}{2}}$

i. Derive Simpson's $\frac{1}{3}$ rule for x_0=a, $x_1 = \frac{a+b}{2}, x_2 = b$ and n=2.

j. Given the following values of $f(x)=ln\ x$. Find the approximate value of f'(2.0) using linear interpolation.

i	0	1	2
xi	2.0	2.2	2.6
fi	0.69315	0.78846	0.95551

PART-IV

Answer all questions. 6x4

4. Find the smallest positive root of the equation x^3-5x+3=0 by Newton Raphson method by taking four iterations.

OR

Find the approximate root correct upto two decimal places of equation x^2=3 by Secant method.

2.06640 34.38

34.3281

4.2910 (3.25²) 2.0664

5. Find the inverse of the co-efficient matrix of the system.

$$\begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 6 \\ 4 \end{bmatrix} \text{ by}$$

Gauss - Jordan method with partial Pivoting and hence solve the system.

OR

If A is strictly diagonally dominant matrix, then show that the Gauss-Seidel iteration Scheme Converges for any initial Starting vector.

6. From table of Logarithm find interpolating polynomial of $\log x$ and find log 1.25 by Newton Divided Difference.

x	1.0	1.5	2.0	2.5
$\log x$	0	0.17609	0.30103	0.39794

OR

Derive Newton forward difference interpolating polynomial of $f(x)$ at $x_0 = a, x_1 \ldots x_n = b, x_i = x_0 + ih$.

7. Derive Newton - Cotes rules and find its error.

OR

Using six intervals of equal length, obtain the approximate value of $\int_0^1 \frac{dx}{1+x}$ by Simpson's $\frac{1}{3}$ rule.

2345
243BS

+3-IV-S-CBCS(MS)-Arts/Sc(H)-Core-X-Maths-R&B

2025

Time :As in Programme

Full Marks : 80

The figures in the right-hand margin indicate marks.

*Answer **all** questions.*

PART-I

1. Answer all Questions. 1x12

   a. Write the characteristics of Ring R.

   b. Is $Z \oplus Z$ is an integral domain ? (Yes/No).

   c. The polynomial x^2+1 is reducible over ____.

   d. Is the mapping Z_5 to Z_{30} given by $x \rightarrow 6x$ a ring homomorphism ? (Yes/No)

   e. Give an example of integral domain which is not UFD.

   f. The characteristic of an integral domain is a prime only. (True/false)

   g. $\{2,0,4\}$ is a subring of the ring Z_6, the integers of modulo 6. (True/false)

   h. If the leading coefficient of a Polynomial $f(x) \in R[x]$ is the multiplecative identity of $R[x]$ then $f(x)$ is called ____ Polynomial.

   i. Is the Polynomial $f(x)=2x^2+4$ irreducible over Z ? Yes/ no.

   j. $f(x)=x^2+1$ has zero in Z_3 (True/false)

   k. Is the ring Z is a Euclidean domain ? (Yes/ no)

   l. Find the idempotent in Z_{10}.

(Turn Over)

PART-II

2. Answer any eight questions. 2x8

a. Let a$\in$ a ring R, prove that 0a=a0=0.

b. If R has a Unity element 1, then prove that (-1)a=-a.

c. Define a field.

d. When an integral domain is send to be a Unique factorization domain ?

e. Define Kernel of a ring homomorphism R.

f. Show that R, the set of real numbers is a subring of C.

g. Define principal Ideal domain.

h. Find all maximal ideals of $Z_8 \oplus Z_{30}$.

i. Define associates of an integral domain.

j. Define Unique Factorization domain.

PART-III

3. Answer any eight of the following questions. 3x8

a. If a, b$\in$ R, Prove that (-a)(-b)=ab where R is a ring.

b. If ϕ is a homomorphism of a ring R into a ring R with Kernel S, then show that S is an ideal of R.

c. Find all units, zero divisor, idempotents and nilpotent elements in $Z_3 \oplus Z_6$.

d. Let F be a field. If $f(x) \in$ F[x} and deg f(x)=2 or 3, then prove that $f(x)$ is reducible over F iff $f(x)$ has a zero in F.

e. Prove that $\phi: x \rightarrow 5x$ from Z_4 to Z_{10} is a ring homomorphism.

f. Explain why every subgroup of Z_n under addition is also a subring of Z_n ?

g. List all the Polynomials of degree 2 in Z_2[x] which of these are equal as functions from Z_2 to Z_2.

h. Give an example of commutative ring that has a maximal ideal but is not a prime ideal.

i. Prove that every Euclidean domain is a principal ideal domain.

j. Show that 1-i is an irreducible in Z[i].

PART-IV

Answer all questions. 7x4

4. Define integral domain and prove that a finite integral domain is a field. Is the converse true ?

OR

Let a$\in$ a ring R. Let S={x$\in$ R:ax=0}. Show that S is a subring of R.

5. Let ϕ be a ring homomorphism from a ring to a ring to S. Then

Ker $\phi = \{r \in R : \phi(x) = 0\}$ is an ideal of R.

OR

Let R be a commulative ring with unity and A be an ideal of R. Then prove that R/A is a field iff A is maximal.

6. State and prove Division algorithm for F[x].

OR

Let $f(x) \in z[x]$. if $f(x)$ is reducible over Q, then prove that it is reducible over Z.

7. Prove that in a principal ideal domain, an element is an irreducible iff it is a prime.

OR

Let P(x) is an irreducible polynomial over a field F. Prove that the ideal generated by P(x) in F(x) is a maximal ideal.

+3-IV-S-CBCS(MS)-Arts/Sc(H)-Core-IX-Maths-R&B

2025

Time :As in Programme

Full Marks : 80

The figures in the right-hand margin indicate marks.

*Answer **all** questions.*

PART-I

1. Answer all Questions. 1x12

a. What is the derived set of set $A=\left\{\frac{1}{n}:n\in N\right\}$ in Euclidean Metric space ?

b. Let X be a nonempty set and d on X defined by $d(x,y)=\begin{cases}1, x\neq y\\0, x=y\end{cases}$, then d is called ____ metric.

c. What can be said about Uniform continuity of the function $f:R_U\rightarrow R_U$ defined by $f(X)=X^2$?

d. Any subspace of a second countable space is also second countable. (True/False)

e. What can you say about the continuous image of a connected space ?

f. Is $Y=\{x\in R:1<x<2\}$ dense in R ? (Yes / No)

(Turn Over)

g. The distance between

$$a = \left\{(x, y) \in R^2, Y = \frac{1}{x} \neq 0\right\} \text{ and}$$

$$b = \left\{(x, y) \in R^2, Y = 0\right\} \text{ is \_\_\_\_.}$$

h. A composition of two uniformly continuous mapping is again Uniformly continuous. (True/False)

i. Let A=ϕ and B=R then $A^0 \cup B^0$ = ____.

j. The Singleton set $\{x\}$ on any metric space x is connected. (True/false)

k. A totally bounded metric space is also bounded. True or false.

l. In a metric space, any two disjoint sets are always separated. Write true or false.

PART-II

2. Answer any eight questions. 2x8

a. Define Euclidean metric on R^n.

b. Let (X:d) be a metric space and $x \in$ X, then define local base at X.

c. Define a Cauchy sequence in a metric space.

d. Define compact metric space.

e. Is the subset {3n+1, n$\in$ z}, {3n, n$\in$ z} and {3n+2, n$\in$ z} forms an open cover of z. Explain.

f. Define the local base of an element X in a Metric Sapce (X,d).

g. Let (X,d) be a metric space and A, B be subsets of X. Show that $A \subseteq B \Rightarrow A^0 \subseteq B^0$.

h. Define Isometric functions.

i. Define Pseudo-Metric space.

j. Let X be a complete space. Then does the mapping $T: X \to X$ have a fixed point ? Justify.

PART-III

3. Answer any eight of the following questions. 3x8

a. Prove that the Cauchy Sequence of real numbers is convergent.

b. Prove that in any metric space (x,d) each open ball is an open set.

c. If (X, dx), (Y, dy) and (Z, dz) are metric spaces and if $f: X \to Y$ and $g: Y \to Z$ are continuous, then prove that $gof: X \to Z$ is also continuous.

d. Prove that in any metric space, there is a countable base at each point.

e. Prove that two metrics d_1 and d_2 on a non-empty set X are equivalent if there exists a constant K such that

$$\frac{1}{k} d_2(x, y) \leq d_1(x, y) \leq k d_2 (x, y), \forall x, y \in X .$$

f. Show that $f: R \to (-1,1)$ defined by $f(x) = \dfrac{x}{1+|x|}$ is a homomorphism.

g. Let (X,d) be a metric space and A, B be subsets of X. Then prove that $(A \cup B)^0 \supseteq A^0 \cup B^0$

h. Let $f(x) = \sin\left(\dfrac{1}{x}\right), x \in R-\{0\}$. Prove that the function f can't be extended to a continuous function on R.

i. If $X = Y_1 \cup Y_2$ and Y_1 is of category I while X is of category II, then prove that Y_2 must be category II.

j. Let f:[-1,1]$\rightarrow$[-1,1]. show that there is a fixed point C$\in$ 1 such that f(C)=C.

PART-IV

Answer all questions. 7x4

4. Prove that the space l^p is complete.

OR

State and prove Cantor's theorem.

5. Let T:X$\rightarrow$X be a contraction of the complete metric space (X,d). then prove that T has a unique fixed point.

OR

Let (X,d) be a metric space. Then prove that the following statements are equivalent.

i. (X,d) is disconnected

ii. There exist a continuous mapping of (X,d) onto the discrete two element space (X_0, d_0)

6. Prove that $f: X \rightarrow Y$ is continuous on X iff f^{-1} (G) is open in X for all open subsets G and Y.

OR

Show that the sequence $\{f_n\}_{n\geq 1}$ defined by

$f_n(x) = \tan^{-1}(nx), x \geq 0$ is uniformly convergent on $[\alpha, \infty)$ when $\alpha > 0$, but not uniformly convergent on $[0, \infty)$.

7. If f and g are two continuous maps on a metric space (X,d) then using $\varepsilon - \delta$ method prove that f+g and fg are continuous on X.

OR

Prove that in a metric space, every convergent sequence has a Unique limit.