+3-IV-S-CBCS-Arts/Sc/Com(H&P)-AECC-E&V-IV(R&B)

2023

Time :As in Programme

Full Marks : 25

The figures in the right-hand margin indicate marks.

*Answer **all** the questions*

PART-I

1. Answer the following questions in one sentences (any five). 1x5

ଯେକୌଣସି ପାଞ୍ଚଟି ପ୍ରଶ୍ନର ଉତ୍ତର ଗୋଟିଏ ବାକ୍ୟରେ ଦିଅ ।

a. Write one source of knowledge.

ଜ୍ଞାନର ଏକ ଉତ୍ସ ଉଲ୍ଲେଖ କର ।

b. What is ability to learn ?

ଶିକ୍ଷଣ ଦକ୍ଷତା କହିଲେ କ'ଣ ବୁଝ ।

c. Give one positive function of conflict.

ସଂଘର୍ଷର ଏକ ଅସ୍ତିସୂଚକ ପ୍ରକାର୍ଯ୍ୟ ଉଲ୍ଲେଖ କର ।

d. Write one benefit of hostel life.

ଛାତ୍ରାବାସ ଜୀବନର ଗୋଟିଏ ଉପକାରିତା ଉଲ୍ଲେଖ କର ।

e. Give one example of violation of intellectual Property Rights.

ବୌଦ୍ଧିକ ସମ୍ପତ୍ତି ଅଧିକାରର ଉଲ୍ଲଙ୍ଘନର ଏକ ଉଦାହରଣ ଦିଅ ।

(Turn Over)

f. Write one importance of co-curricular activity.

ପାଠ୍ୟକ୍ରମ କାର୍ଯ୍ୟାବଳୀର ଗୋଟିଏ ଗୁରୁତ୍ୱ ଲେଖ ।

g. Write one important characteristics of an effective leader.

ଜଣେ ସଫଳ ଉଦ୍ୟମୀ ନେତାର ଏକ ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ ଗୁଣ ଉଲ୍ଲେଖ କର ।

PART-II

2. Answer any five questions within 50 words. 2x5

୫୦ଟି ଶବ୍ଦ ମଧ୍ୟରେ ସଂକ୍ଷିପ୍ତ ଟିପ୍ପଣୀ ଦିଅ । (୫ଟି ପ୍ରଶ୍ନ)

a. Causes of student failure

ଛାତ୍ର ବିଫଳତାର କାରଣ

b. Energy conservation

ଶକ୍ତି ସମ୍ବଳର ସଂରକ୍ଷଣ

c. Hostel life

ଛାତ୍ରାବାସ ଜୀବନ

d. Community life

ଗୋଷ୍ଠୀଗତ ଜୀବନ

e. Plagiarism checking

ଭାବଚୌର୍ଯ୍ୟ ନିୟନ୍ତ୍ରଣ

f. Conflict

ସଂଘର୍ଷ

g. Green preacher

ସବୁଜ ପ୍ରଚାରକ

h. Positive friendship

ପ୍ରକୃତ ବନ୍ଧୁତ୍ୱ

PART-III

3. Answer any two questions (250 words) 5x2

ଯେକୌଣସି ଦୁଇଟି ପ୍ରଶ୍ନର ଉତ୍ତର ଦିଅ । (୨୫୦ ଶବ୍ଦ ମଧ୍ୟରେ)

a. Bring out the differences between academic qualification and ability of a student.

ଏକ ଛାତ୍ରର ଆନୁଷ୍ଠାନିକ ଯୋଗ୍ୟତା ଓ ଦକ୍ଷତା ମଧ୍ୟରେ ପାର୍ଥକ୍ୟ ଦର୍ଶାଅ ।

b. What are the important traits of interpersonal relationship. Explain.

ଆନ୍ତଃ ବ୍ୟକ୍ତିଗତ ସମ୍ପର୍କର ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ ପ୍ରଲକ୍ଷଣଗୁଡ଼ିକ କ'ଣ ? ଆଲୋଚନା କର ।

c. Explain the steps taken for conservation of energy.

ଶକ୍ତି ସମ୍ପଦର ସଂରକ୍ଷଣ ପାଇଁ ନିଆଯାଉଥିବା ପଦକ୍ଷେପ ସବୁ ବର୍ଣ୍ଣନା କର ।

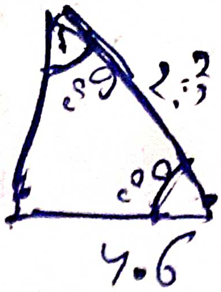
d. Write down the importance of co-curricular and extra co-curricular activities in educational institutions.

ଶିକ୍ଷାନୁଷ୍ଠାନଗୁଡ଼ିକରେ ପାଠ୍ୟକ୍ରମ ଓ ସହ ପାଠ୍ୟକ୍ରମ କାର୍ଯ୍ୟାବଳୀର ଗୁରୁତ୍ୱ ଉଲ୍ଲେଖ କର ।

e. Explain the concept and qualities of ethical leadership.

ନୈତିକ ନେତୃତ୍ୱର ଅବଧାରଣା ଓ ଗୁଣାବଳୀ ବ୍ୟାଖ୍ୟା କର ।

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



2023

Time :As in Programme

Full Marks : 60

The figures in the right-hand margin indicate marks.

*Answer **all** questions.*

PART-I

1. Fill in the blanks/ One word answer. 1x8

a. 'Density' is an _____ property. (extensive / intensive)

b. If the energy of the products is less than the energy of the reactants, then the system is _____.(endothermic/ exothermic)

c. For an equilibrium reaction ΔG will be _____. (zero, negative, positive)

d. The maximum pH value in the pH scale is _____.

e. Out of NaCl and CH_3COONa which will never undergo hydrolysis ?

f. Write the structure of o - cresol.

g. Out of CH_3CH_2Cl and $(CH_3)_3C\text{-}Cl$ which will undergo SN2 reaction ?

h. $CH_3-\overset{\overset{\displaystyle O}{||}}{C}-H + HCN \rightarrow A.$

Here 'A' is _____.

(Turn Over)

PART-II

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

a. How can you convert CH_3COCl in to CH_3CHO ?

b. How can you prepare phenol from cumene hydroperoxide method ?

c. Convert CH_3CHO to CH_3CH_2OH

d. Explain SNi reaction.

e. What happens when sodium benzoate is heated with sodalime ? Give chemical equation.

f. Explain sandmeyer reaction.

g. Discuss about strong and weak electrolytes.

h. Write three factors affecting degree of ionization.

i. Write the relationship between Kc and Kp for the following reaction.

$$N_2(g)+3H_2(g) \rightleftharpoons 2NH_3(g)$$

j. Write the statement of third law of thermodynamics.

PART-III

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

a. State and explain First Law of thermodynamics.

b. What is bond energy ? Write the factors affecting bond energy.

c. Write the distinction between ΔG and ΔG^o.

d. Calculate the pH of 0.01 M H_2SO_4.

e. If solubility of a sparingly soluble salt AB is 2×10^{-5} $molL^{-1}$, then what will be its solubility product ?

(Contd.)

f. What do you mean by ionic product of water ? What is the effect of temperature on it ?

g. How can you prepare benzene from acetylene ?

h. What is Willamson's synthesis ?

i. Discuss about Lucas test.

j. Explain Wolff-Kishner reduction.

PART-IV

Answer within 500 words each. 6x4

4. Write short notes on :

   a. Cannizzaro's reaction

   b. Benzoin condensation reaction

OR

Write short notes on :

   a. Reimer - Tiemann reaction

   b. Pinacol - Pinacolone rearrangement

5. How can you prepare chloro benzene from (i) Phenol and (ii) Gattermann reaction ? Discuss about Benzyne mechanism.

OR

How can you prepare isopropyl alcohol using Grignard reagent ? Write the reaction of isopropyl alconol with (i) Alk.$KMnO_4$ and (ii) CH_3COOH in presence of acid catalyst.

6. Write short notes on :

a. Buffer solution

b. Common ion effect

OR

Explain hydrolysis of salt of weakacid and strong base. Calculate hydrolysis constant, degree of hydrolysis and pH of solution.

7. State and explain Le-chatelier's principle. Write its application in industrial processes.

OR

Discuss about Kirchoff's equation.

2023

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. How many significant digits does the floating point number 0.05260×10^3 have ?

   b. When solving an upper triangular system of size m x m, the computational cost measured in terms of Multiplication and division is nearly equal to ____.

   c. Find the interval in which the smallest positive root of the equation $x-e^{-x}=0$ lies.

   d. The interpolating polynomial p(x) that interpolates f(x) at $x_0, x_1, ..., x_n$ is at most degree ____.

   e. The relation between the shift operator and forward difference operator is ____.

   f. In any numerical differentiation, the local truncation error is always inversly propertional to some power of h. Write true or false.

   g. According to Euler's method for finding the solution of $\frac{dy}{dx} = f(x,y)$ the approximation y_{n+1} = ____.

(Turn Over)

h. The order of error in Simpson's rule for numerical integration with step size h is ____.

PART-II

2. Answer any eight questions.

1.5x8

a. Define truncation error and give an example where truncation error is applied.

b. Write the condition for which an iterative function $x = \phi(x)$ converges to real root x=c of f(x)=0 in (0,1].

c. Write some properties of lagrange's function $l_i(x)$.

d. Write Newton Cotes Quadrature formula involving (n+1) nodes $x_0, x_1, \ldots, x_n$ with $w_i x_o = x_o + \alpha h, 0 \le \alpha \le h$.

e. Write composite Simpson's $\frac{1}{3}$ rule

$a = x_0 < x_1 < \ldots < x_{2n-1} < x_{2n} = b$ and its error term.

f. Write the condition for the convergence of Gauss - Jacobi iteration.

g. Write the condition where Newton Raphson's method fails.

h. Show that the Divided difference of a constant is zero.

i. Find x, y in the divided difference table

x	f(x)	1st order divided difference	2nd order divided difference
1	1	y	-1
2	x		
4	16	4	

j. Find the value of $\int_0^2 f(x)dx$ by trape zoidal rule if f(0)=4, f(1)=3, f(2)=12.

PART-III

3. Answer any eight of the following. 2x8

a. Find the percentage of error if x=0.1346 is approximated by x*=0.134.

b. Perform two iterations of bisection method to obtain the root of the equation $x^3-5x+1=0$.

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

d. Prove that $\nabla^2 f_n = (E-1)^2 f_n$.

e. Compute $\int_0^1 e^{-x^2} dx$ using Simpson's $\frac{1}{3}$ rule.

f. Find n suitable iteration function to find the root of the equation sin x = 10(x-1).

g. Find the step size 'h' that can be used in the tabulation of f(x) = sin x in, the interval [1,3] so that the linear interpolation will be correct to four decimal places after rounding.

h. Find the 1st iterative solution of the system x-2y=1 and x+4y=4 by using Gauss - seidel method.

i. Explain Richard-son extrapolation in brief and why it is used for.

j. Find approximate to $\frac{d}{dx}\left(\frac{1}{x}\right)$ at x=1 for h=0.2 and 0.002.

PART-IV

Answer all questions. 6x4

4. Perform four iteration of Newton Ruphson method to obtain the approximate value of $(17)^{1/3}$ starting with the initial approximation $x_0=2$.

OR

Find all positive roots of the equation $10\int_0^x e^{-x^2}dt - 1 = 0$ with six correct decimals.

5. Prove that Newton-Raphson's method is quadratically convergent with asymptotic error constant equals to $\frac{1}{2}\frac{f''(\alpha)}{f'(\alpha)}$

OR

Solve the following system by Gauss - Jacobi method.

8x+2y-2z=8, x-8y+3z=-8, 2x+y+9z=12

6. Obtain the quadratic splines representating the function defined by

x	0	1	2	3
$f(x)$	1	3	11	31

Assume that $f''(0)$=M(0) =0. Interpolates x=1.5.

OR

Derive Newton's divided difference interpolation formula and its error.

7. Evaluate $\int_0^1 \frac{dx}{1+x}$ correct to three decimal places with h=0.125 by using Simpson's $\frac{1}{3}$ rule.

OR

Evaluate $\int_0^1 x^2 dx$ using composite trapezoidal rule by dividing [0,1] into eight parts.

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

2023

Time :As in Programme

Full Marks : 80

The figures in the right-hand margin indicate marks.

*Answer **all** questions.*

PART-I

1. Answer the following questions. 1x12

a. The Convergence of a sequence in a metric space (x,d) depends on X only. Write true or false.

b. Let A=[0,1] and B=[1,2] then $(A \cup B)^0$ = ____.

c. Let (x,d) and (x', d') be two metric spaces A mapping f' of X into x' is an isometry if d'(f(x), f(y)) = ____.

d. The composition of two uniformly continuous functions is uniformly continuous. (T/F).

e. Let (x,d) be a metric space. A subset $Y \subseteq X$ is said to be nowhere dense if $(\overline{Y})^0$ = ____.

f. Let (x,d) denotes the discrete metric space then s(x,r)=____ for all x$\in$X and r>1.

g. If a metric space (x,d) has a countable base for its open sets, then it is called ____.

h. The set of irrationals in R is of category I. (T/F)

(Turn Over)

i. Are the metric spaces [0,1] and [0,2] with usual absolute value metric are homeomorphic. (yes/no)

j. The series of functions $\sum f_n$ when $f_n = x^n$ converges at x=1 (True/false)

k. Let $T:X \to X$ satisfy the inequality $d(T_x, T_y) < d(x,y)$ for all $x,y \in X$. Can T have a fixed point. (Yes/No)

l. Let $X = \{x \in R : h < x < b \text{ or } c < x < d\}$. Where b<c with the induced metric from (R,d) then X is _____.

(Connected / locally connected)

PART-II

2. Answer any eight questions. 2x8

a. Write Cauchy-Schwarz inequality.

b. Define Pseudometric on X.

c. What do you mean by subsequential limit of {xn} $n \geq 1$ in a metric space (x,d).

d. Define local base at x where $x \in X$ and (x,d) be a metric space.

e. Let R be the real line with the usual metric. Is Y defined by $\{x \in R : 1 < x < 2\}$ dense in R.

f. Give examples of F_6 type set of R.

g. Define extension of a mapping 'f'.

h. Define equivallent metric spaces.

i. When a metric space (x,d) is said to be connected ?

j. Is (0,1) in the metric space (R,d) where 'd' denotes the usual metric compact ? Explain.

PART-III

3. Answer any eight of the following. 3x8

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

b. Prove that a convergent sequence in a metric space is a Cauchy Sequence.

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

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

e. Prove that a non empty open interval is of category II.

f. Define Oscillation of a function over an interval and at a point.

g. Show that the function $f:[0,1] \to R$ defined by $f(x)=x^2$ is uniformly continuous.

h. Let $x\{x_n\} \in l_2$. Then prove that $T_x = \left\{\frac{x_n}{2}\right\}$ is a contraction mapping of l_2 into itself.

i. Let $I=[-1,1]$ and let $f:I \to I$ be continuous. Then prove that there exist a point $c \in I$ such that $f(c)=c$.

j. If Y is a connected set in a metric space (x,d) then prove that any set Z such that $Y \subseteq Z \subseteq \overline{Y}$ is connected.

PART-IV

Answer all questions. 7x4

4. Let $\{x^{(n)}\}_{n \geq 1}$ be a sequence in l_p such that $\lim_{n \to \infty} x_k^{(n)} = x_k$ for each k, where $x = \{x_k\}_{k \geq 1}$ is an elensent of l_p, suppose also that for every $\in >0$, there exist an integer $m_0(\in)$ such that $\left(\sum_{k=m+1}^{\infty} |x_k^{(n)}|p\right)^{1/p} < \in, m \geq m_0(\in)$ and for all n. Then prove that $\lim_{n \to \infty} d(x^{(n)},x)=0$.

OR

(Turn Over)

Let f_1, f_2 be subsets of a metric space (x,d) then prove that

a. $\overline{(F_1 \cup F_2)} = \overline{F}_1 \cup \overline{F_2}$

b. $\overline{(F_1 \cap F_2)} \subseteq \overline{F}_1 \cap \overline{F_2}$

5. Let (x,d) be a metric space and Y a subspace of X. Let Z be a subset of Y then prove that Z is open in Y iff there exists an open set $G \subseteq X$ such that $Z = G \cap Y$.

OR

Let (x,d) be a metric space and $Y \subseteq X$ if X is separable, then prove that Y with the induced metric is separable too.

6. Let (X, d_X) and (Y,d_Y) be metric spaces and $A \subseteq X$. Prove that a function $f: A \rightarrow Y$ is continuous at $a \in A$ iff whenever a sequence $\{x_n\}$ in A converges to a, the sequence {f(xn)} converges to f(a).

OR

Let (X,d_X) and (Y,d_Y) be metric spaces and let f and g are continuous functions from X to Y. Then prove that the set $\{x \in X: f(x)=g(x)\}$ is a closed subset of X.

7. State and prove contraction mapping principle.

OR

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

a. (x,d) is disconnected.

b. There exist a continuous mapping of (x,d) onto the discrete two element space (x_0, d_0).

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

2023

Time :As in Programme

Full Marks : 80

The figures in the right-hand margin indicate marks.

*Answer **all** questions.*

PART-I

1. Answer the following questions. 1x12

a. The Unity element of the subring $\{0,2,4\}$ of the ring Z_6 is _____.

b. Every integral domain is a field. (T/F)

c. For any ring R, is a ideal of R. (T/F)

d. $\langle x^2+1\rangle$ is a prime ideal in $Z_2[x]$. (T/F)

e. In the ring of integers find positive integer 'a' such that $\langle a\rangle=\langle 6\rangle+\langle 8\rangle$.

f. The number of ring homomorphism from z to z is _____.

g. Is there a ring homomorphism from the reals to some ring whose kernel is the integers.

h. If the leading co-efficient is the multiplicative identity of R, f(x) is called _____ polynomial.

i. Is the polynomial irreducible over R ?

(Turn Over)

j. The number of reducible polynomials over Z_5 of the form x^2+ax+b is _____.

k. All Unique factorization domain is a principal ideal domain. (T/F)

l. Find all idempotents in Z_{10}.

PART-II

2. Answer any eight questions. 2x8

a. Show that R is a commutative ring satisfies $a^2 = a, \forall a \in R$.

b. Define factor ring.

c. Find a subring of $Z \oplus Z$ that is not an ideal of $Z \oplus Z$.

d. Define ring isomorphism.

e. Is the mapping from Z_5 to Z_{30} given by $x \to 6x$ a ring homomorphism ?

f. Are there any non constant polynomials in Z[x] that have multiplicative inverse.

g. Is the polynomial x^4+3x^2+3 irreducible over Q.

h. Define content of a polynomial.

i. Define Euclidean domain.

j. Is $Z\left[\sqrt{-6}\right]$ is a unique factorization domain ? Explain.

PART-III

3. Answer any eight of the following. 3x8

a. If a, b are in a ring R, prove that (-a) (-b) = ab.

b. Let $a \in R$. Let $S=\{x \in R | ax=0\}$ show that 'S' is a subring of R.

c. Give an example of ring elements a and b with properties that $ab=0$ but $ba \neq 0$.

d. If A and B are ideals of a ring. Show that $A+B=\{a+b\ ;\ a \in A, b \in B\}$ is an ideal.

e. Give an example of a ring that has exactly two maximal ideals.

f. If ϕ is an isomorphism from R onto S then prove that ϕ^{-1} is an isomorphism from S onto R.

g. Prove that every ring homomorphism ϕ from z_n to itself has form $\phi(x)=ax$ where $a^2=a$.

h. If D is an integral domain, then prove that D[x] is an integral domain.

i. Let p be a prime. Are there any non constant polynomials in $Z_p[x]$ that have multiplicative inverse.

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

PART-IV

Answer all questions. 7x4

4. Suppose R is a commutative ring without zero-divisior. Show that the characteristic of R is 0 or prime.

OR

Let R be a ring and let A be a subring of R. The set of cosets $\{r+A : r \in R\}$ is a ring under the operations $(s+A)+(t+A)=s+t+A$ and $(s+A)(t+A) = st+A$ iff A is an ideal of R.

5. Let D be an integral domain. Then prove that there exists a field F that contains a subring isomorphic to D.

OR

Let ϕ be a ring homomorphism from a ring R to a ring S. Prove that ϕ is an isomorphism iff ϕ is onto and ker ϕ $\{r \in R: \phi(r)=0\}=\{0\}$.

6. State R and prove Division algorithim 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. Show that the ring $Z\left[\sqrt{-5}\right]=\left\{a+b\sqrt{-5}: a, b \in Z\right\}$ is an integral domain but not a unique factorization domain.

OR

Prove that every principal ideal domain is a Unique factorization domain.