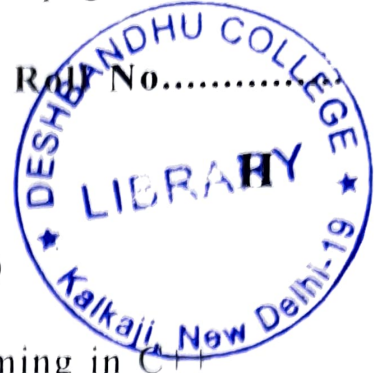


[This question paper contains 4 printed pages.]

Your Roll No.....



Sr. No. of Question Paper : 3317

Unique Paper Code : 42343409

Name of the Paper : Programming in C++

Name of the Course : **BSc. (Prog.) Physical
Science/Mathematical
Science**

Semester : IV

Duration : 2 Hours

Maximum Marks : 25

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Parts of the question must be answered together.
3. Marks are indicated against each question.

SECTION A

1. (5×2=10)
(a) What is Polymorphism in OOP?

(b) Create a class Box in C++ having three data members: Length, Width and Height.

P.T.O.

(c) Rewrite the following code using while loop:

```
for (int i = 1; i <=10; i++)  
    cout << i;
```

(d) Write output of the following code :

```
int array[ ] = {0,2,4,6,7,5,3};  
int n, result = 0;  
for (n = 0; n < 8; n++)  
    result += array[n];  
count << result;
```

(e) Write a C++ loop to display all perfect squares till 100.

It should display : (1, 4, 9, 16, 25, 36, 49, 64, 81, 100).

SECTION B

Attempt any **three** questions : (5×3)

2. (a) Write a function power that accepts two integers x and y as arguments and returns y^{th} power of x that is x^y . (3)
- (b) Define the function main() that calls the above function and displays results for the following values : $x = 3$, $y = 4$. (2)
3. (a) Which of the following is a valid function declaration? Justify your answer. (3)

- (i) `int fl(int i = 1, int j = 2, int k);`
- (ii) `int fl(int i = 1, int j, int k = 2);`
- (iii) `int fl(int i, int j = 2, int k = 3);`

(b) What are inline functions? When will you make a function inline? (2)

4. (a) (i) Create a 2-dimensional character array initialized with all days of a week.
- (ii) Create a variable that holds an integer value that may never be changed. (3)

(b) Give the output of the following code, justify your answer : (2)

```
// Assume that integers take 4 bytes.
#include<iostream>
using namespace std;
class Test
{
    static int i;
    int j;
};
int main()
{
    cout << sizeof(Test);
    return 0;
}
```

5. (a) What is the sequence of constructors and destructors being called in the following multilevel inheritance : (3)

```
class A
{...};
class B: public A
{...};
class C: public B
{...};
class D: public C
{...};
```

- (b) What is function overloading? Give examples. (2)

6. (a) Find the errors in the following code segments : (3)

```
(i) int func (int x, y)
    {
    int z;
    Count << z;
    }
```

```
(ii) class du
    {
    Private :
    ... ;
    Public :
    Void ~ du (void);
    }
```

- (b) Write an example class containing one data member and one member function. (2)

Sr. No. of Question Paper : 3430

Your Roll No

Unique Paper Code : 42224412

Name of the Course : B.Sc. (Prog.) Physical Science

Name of the Paper : Waves and Optics

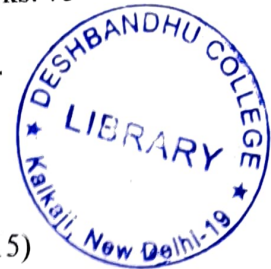
Semester IV

Duration: 3 Hours

Maximum Marks: 75

Instructions for Candidates:

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any Five questions in all. Question No. 1 is compulsory.
3. Simple non-programmable calculators are allowed.
4. All questions carry equal marks.



(3x5=15)

1. Attempt all of the following:

- (a) What are coherent sources? Give examples.
- (b) How will you test the flatness of surface by interference of light?
- (c) Compare the action of zone plate and convex lens.
- (d) Refractive index of water is 1.33. Calculate the angle of polarization of light reflected by the surface of pond.
- (e) What do you understand by half and quarter wave plates?

2 (a) Two colinear simple harmonic motions are acting simultaneously on a particle. Show that the resultant motion of particle is simple harmonic motion. Also, obtain the expression for amplitude and phase constant of the resultant motion in term of their amplitudes and phase difference. (8)

(b) Two colinear simple harmonic motions acting simultaneously on a particle are given by $x_1=0.3 \cos 2\omega t$ and $x_2=0.2 \sin(2\omega t-\pi/3)$. where x is expressed in cm and t in seconds. Write down the expression for the resultant displacement as a function of time. (7)

3 (a) State the principle of superposition and prove that it holds only for linear differential equations. (8)

(b) Deduce the expression for the velocity of transverse waves on a long-stretched string. (7)

4 (a) Give the theory of formation of Newton's rings by reflected monochromatic light and prove that radii of these rings are proportional to the square root of natural numbers. (10)

(b) The diameter of the tenth bright ring in Newton's rings experiment is 0.5 cm in reflected system. Calculate the thickness of air film corresponding to this ring and the radius of curvature of the lens. (Given $\lambda=5890 \text{ \AA}$). (5)

5 (a) How thickness of thin glass or mica strip is measured using Fresnel's biprism. Derive the necessary formula used. (10)

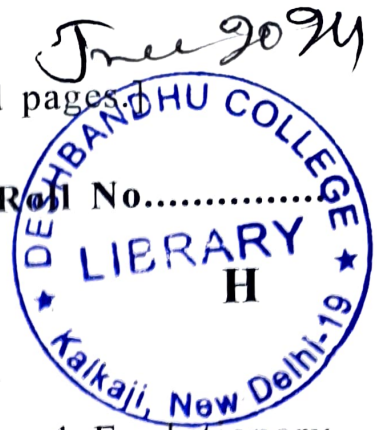
(b) A thin mica sheet (refractive index =1.6) of 7 micron thickness introduced in path of the interfering beams in the biprism arrangement shifts the central fringe to the position normally occupied by 7th bright fringe from the centre. Find the Wavelength of light used. (5)

6 (a) Give the theory of Fraunhofer diffraction due to single slit. (10)

(b) In the Fraunhofer diffraction due to a narrow slit, a screen is placed 2 metres away from the lens to obtain the pattern in its focal plane. Find the slit width if the first minima lie 5 mm on the either side of the central maxima when the plane waves of wavelength 6×10^{-5} cm are incident on the slit. (5)

[This question paper contains 4 printed pages.]

Your Roll No.....



Sr. No. of Question Paper : 3491

Unique Paper Code : 42234406

Name of the Paper : Genetics and Evolutionary
Biology

Name of the Course : **B.Sc. (P) Life Sciences**

Semester : IV

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **Section A & B** on separate answer sheets.
3. Question No. 1 of each section is compulsory.

SECTION A – GENETICS

Attempt **three** questions in all, including
Question No. 1 which is compulsory.

1. (i) Define the following terms (**any five**) : (5)
 - (a) Lethal allele
 - (b) Base analog
 - (c) Intersex
 - (d) Holandric trait

P.T.O.

(e) Recombination frequency

(f) Pericentric inversion

(ii) State an important contribution of the following scientists (**any three**): (3)

(a) H. J. Muller

(b) C. B. Bridges

(c) G. Barski

(d) A. Sturtevant

(iii) Differentiate between the following (**any two**): (2×2)

(a) Pleiotropy and Multiple alleles

(b) Transition and Transversion

(c) Cis-coupling and Trans-coupling phase

(iv) How many different types of gametes will be formed by a parent having following genotypes: (2)

(a) AaBbCcDdEe

(b) AaBBCcDDEe

2. (a) Describe Mendelian traits with the help of suitable examples. How do they differ from polygenic traits. (7)

- (b) Illustrate the use of 'Three-Factor Crosses' in chromosome mapping. (5)
3. (a) What is the difference between aneuploidy and polyploidy? Discuss different types of polyploidy and their significance. (8)
- (b) Explain the mechanism of dosage compensation in mammals? (4)
4. Write short notes on following (**any three**):
- (a) Genic balance theory
- (b) Spontaneous mutations
- (c) Somatic cell genetics
- (d) Epistasis (3×4)

SECTION B – EVOLUTIONARY BIOLOGY

Attempt **three** questions in all, including.

Question No. **1** which is compulsory.

1. (i) Define the following terms (**any five**): (5)
- (a) Gene pool
- (b) Connecting link
- (c) Carbon dating
- (d) Mutation
- (e) Hybrid sterility

(f) Microevolution

(ii) Distinguish between (**any three**) : (3×2)

(a) Natural selection and Artificial selection

(b) Trace fossil and Index fossil

(c) Anagenesis and Cladogenesis

(d) Homologous organs and Analogous organs

(iii) State the contribution of the following scientists
(**any two**) : (2)

(a) Birbal Sahani

(b) Theodosius Dobzhansky

(c) August Weismann

2. What is speciation? Discuss the various mechanisms of speciation. (12)

3. State Hardy-Weinberg law. Explain the various factors causing the deviation of population from Hardy-Weinberg equilibrium. (12)

4. Write short notes on following (**any three**) : (3×4)

(a) Pre-mating isolating mechanisms

(b) Macroevolution

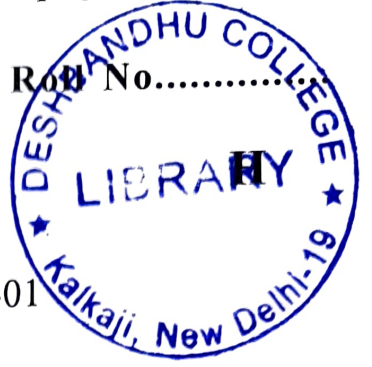
(c) K-T extinction

(d) Organic variation

[This question paper contains 8 printed pages.]

30/31 May
2024

Your Roll No.....



Sr. No. of Question Paper : 4003

Unique Paper Code : 2342572401

Name of the Paper : Operating Systems

Name of the Course : **B.Sc. (Multidisciplinary Courses of Study with Three Core Disciplines under UGCF 2022)**

Semester : IV

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is Compulsory.
3. Answer any **four** Questions from **Section B**.
4. Parts of a question must be answered together.

P.T.O.

Section A

1. (a) Mention names of any two mass storage devices. (1)
- (b) Differentiate between mv and cp commands in Unix/Linux. (2)
- (c) List two main functions of the Operating System. (2)
- (d) What is a thread? What are the benefits of using threads in a programming environment? (1+1)
- (e) What is a two-level directory structure? (2)
- (f) What is the difference between logical and physical address? (2)
- (g) What is dual mode of operation in the context of an Operating system? (3)
- (h) Give an example for absolute path and relative path in a directory? (3)
- (i) Briefly describe the working of Shortest Remaining Time First scheduling algorithm. (3)

- (j) What is meant by the term 'virtual address space' of a process? (2)
- (k) List two system calls for each of the following : (2+2)
- (i) Process control
 - (ii) Device management.
- (l) What is a Process Control Block (PCB)? Elaborate the information stored in it. (1+3)

Section B

2. (a) In a multiprogramming uniprocessor system, how many processes can be in running state and how many processes can be in ready state at a particular time? (2)
- (b) What is the challenge faced by the designers of Operating System while implementing Shortest Job First scheduling algorithm? (2)
- (c) A process goes through various states from its creation to termination. Illustrate the states of a process using a diagram and explain briefly the different states. (3+2)

- (d) The following processes arrive in order P1, P2, P3, P4, P5 at time 0. Draw Gantt chart showing the execution of these processes using SJF (Shortest Job First). Calculate the average turnaround time and average wait time. (3+3)

Process	Burst Time
P1	3
P2	2
P3	7
P4	4
P5	5

3. (a) What is the Unix Kernel? (2)
- (b) What is the purpose of pipes in shell script? Give an example. (1+1)
- (c) Write a shell script to input a number N and print all the prime numbers between 1 and N. The program should be well documented. (5)

(d) A file named abc.txt contains following data

(3×2)

Amit

Bharat

Sanjeev

Sanjay

Dhanraj

Inderjit

Sankalp

What is the output of the following commands:

(i) `grep [s] abc.txt`

(ii) `grep san [^j] cut -c 3,5 abc.txt`

4. (a) Give Unix/Linux commands to remove a file and remove a directory. (2)

(b) Give the advantage of layered design of the Operating System (2)

- (c) What is an Application Programming Interface (API), what are the advantages of a programming environment which uses API. (1+1)
- (d) Explain the difference between system call and system program. (2)
- (e) Each system call will require passing some parameter(s) to the Operating System. What are the three parameter passing techniques? (3)
- (f) List any 4 categories of system programs. (4)
5. (a) What is the purpose of a page table in memory management? (1)
- (b) A memory has a page size of 1 KB. determine the page number and offset for the following addresses (3×2)
- (i) 3085
- (ii) 4205
- (iii) 65000

- (c) Given memory partition sizes of 200KB, 600KB, 100KB, 300KB and 450 KB. How would the processes of sizes 330KB, 250KB, 500KB and 350 KB be placed in the memory for first fit, best fit and worst fit algorithms. Calculate internal and external fragmentation in all three algorithms. (3×2+2)
6. (a) For a paging environment in the main memory, the logical address has two parts - page number and offset. The size of the page frame is 2K. What should be the size of the offset (in bits)? (3)
- (b) What is preemptive and non-preemptive process scheduling? Name two algorithms for each and justify your categorization into preemptive and non-preemptive. (2+4)
- (c) What are the three methods to access data in a file? Give comparison in terms of efficiency and ease of implementation. (6)
7. (a) Draw a labelled diagram showing structure of a magnetic disk. (4)

- (b) What is demand paging? What is Page fault? What are the steps to handle page fault? (1+1+3)
- (c) What is transfer rate, seek time and rotational latency in a disk? A disk has average seek time of 12ms and spins at 7200 RPM (revolutions per minute). Data transfer rate for the disk is 4MB/sec. Calculate the time required to transfer 8KB data to the disk. Assume there are no other time overheads/delays. (3+3)

[This question paper contains 8 printed pages]



Your Roll No.

Sr. No. of Question Paper : 4011

Unique Paper Code : 2172552402

Name of the Paper : DSC : Industrial Chemistry
4 – Pharmaceuticals, Pesticides
and Perfumes

Name of the Course : **B.Sc. (Prog.) with Industrial
Chemistry**

Semester : IV

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt total 4 questions.
3. Every question carries 15 marks.

P.T.O.

1. (a) Fill in the blanks (**any 4**): (1×4)

- (i) Antiperspirants control sweat by blocking _____ ducts.
- (ii) Parathion is a highly toxic organophosphate, primarily used to kill _____ .
- (iii) Streptomycin is primarily used to treat infections caused by _____ .
- (iv) Carbofuran can affect the nervous system of pests by disrupting their _____ .
- (v) Acyclovir helps prevent the replication of viral _____ .

(b) Mark the correct choice (**any 4**): (1×4)

- (i) Cold creams are used primarily to:
 - (a) Cool the skin
 - (b) Cleanse and moisturize the skin
 - (c) Protect skin from UV light
 - (d) Treat acne

- (ii) DDT was heavily used during
- (a) World War II
 - (b) The Great Depression
 - (c) The Cold War
 - (d) The Vietnam War
- (iii) Chloranil is used primarily as a/an :
- (a) Insecticide
 - (b) Herbicide
 - (c) Fungicide
 - (d) Oxidizing agent
- (iv) Glyceryl trinitrate relieves pain by :
- (a) Reducing inflammation
 - (b) Dilating blood vessels
 - (c) Blocking nerve signals
 - (d) Decreasing muscle spasms

(v) Which ingredient helps hairspray hold hair in place?

- (a) Alcohol
- (b) Petroleum
- (c) Polymers
- (d) Water

(c) State True or False (**any 4**) : (1×4)

- (i) Paracetamol is also known as acetaminophen.
- (ii) Shaving creams numb the skin to prevent pain from shaving.
- (iii) Chloranil is used primarily as a fungicide.
- (iv) Hair dye can permanently change the color of hair.
- (v) Carbaryl affect the nervous system of insects.

(c) Give the one word substitute of the following (**any 3**): (1×3)

(i) Class of drug used to treat seizures

(ii) Pesticides used to kill mites and ticks

(iii) Medicines used to treat infections caused by bacteria.

(iv) Medication used to treats bacterial infections

2. (a) Analyze the role of computer-aided drug design in the development of new pharmaceuticals. (3)

(b) What are the following class of drugs (**any two**): Give one example with chemical structure and chemical preparation of each class. (5×2)

(i) Central Nervous System agents

(ii) Antileprosy drugs

(iii) Analgesics

- (c) Discuss with example: natural pesticides. (2)
3. (a) Differentiate between bacteriostatic and bactericidal action. (3)
- (b) Explain the concept of retrosynthetic approach for drug development. (3)
- (c) Give the formulation and preparation of the following cosmetics (any 3): (3×3)
- (i) Cold cream
 - (ii) Shampoo
 - (iii) Lipstick
 - (iv) Antiperspirant lotion
4. (a) What are central nervous system agents? Discuss preparation and major use of phenobarbital.
- (b) What are the main ingredients of lipstick? Discuss the method for the preparation of lipstick.

(c) What is the medicinal importance of drug Dapsone? Give its any commercial synthesis method. (5×3)

5. (a) What are Cardio Vascular agents? Discuss the preparation and major use of Glyceryl trinitrate. (3)

(b) Give the synthesis and uses of any two of the following pesticides : (3×2)

(i) Parathion

(ii) Gammaxene

(iii) Chloranil

(c) Discuss the structure- activity relationship of the following pesticides with one example along with chemical structure :

(i) Carbamate pesticides

(ii) Anilide pesticides (3×2)

6. Write a short note on the following (any 3): (5×3)

(a) Acyclovir

(b) Sun-tan lotions

(c) Chloramphenicol

(d) Environmental impacts of pesticides

[This question paper contains 4 printed pages.]

05/6/24

Your Roll No.

Sr. No. of Question Paper : 4022

Unique Paper Code : 2222512401

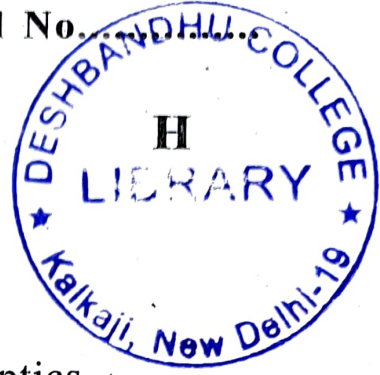
Name of the Paper : Waves and Optics

Name of the Course : B.Sc. Physical Sciences

Semester : IV

Duration : 2 Hours

Maximum Marks : 60



Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **FOUR** questions in all.
3. **All** questions carry equal marks.
4. Question No. 1 is compulsory.
5. Use of non-programmable scientific calculator is allowed.

P.T.O.

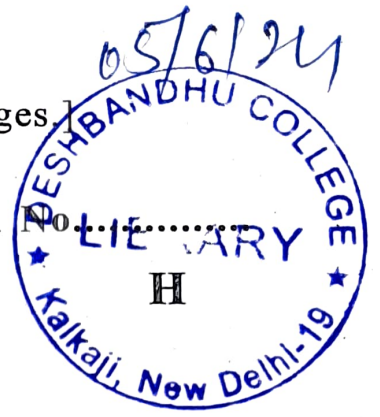
1. Attempt all questions. Each question carries equal marks. (5×3=15)
- (a) Show that superposition principle is true only in case of homogeneous linear equations.
- (b) What are stationary waves? How are they formed?
- (c) In Young's double slit experiment, the separation of four bright fringes is 2.5 mm and the distance from the slit to the screen is 80.0 cm. Calculate the separation between two slits when the wavelength of the light used is 5896 Å.
- (d) Distinguish between Division of amplitude and Division of wavefront categories of interference.
- (e) What is the highest order spectrum which may be seen with a monochromatic light of wavelength 5000 Å with a diffraction grating having 5000 lines/cm?
2. (a) What are Lissajous figures? Give a mathematical analysis to trace graphically the motion of a particle subjected to two perpendicular simple harmonic motions of equal frequencies, different amplitudes and phase differing by (i) zero and (ii) $\Pi/4$.

- (b) All simple harmonic motions are periodic but all periodic motions are not simple harmonic. Explain. (5)
3. (a) Explain the theory of formation of Newton's rings and derive an expression for the diameter of dark rings formed by reflected light. (10)
- (b) Newton's rings are observed in reflected light of wavelength 5900 \AA . The diameter of the 10^{th} dark ring is 0.5 cm . Find the radius of curvature of the lens. (5)
4. (a) Give the theory of Fraunhofer diffraction due to a single slit. Discuss the intensity distribution pattern obtained in it. (10)
- (b) For Fraunhofer diffraction with a single slit of width 0.2 mm and screen placed at a distance of 3.0 m from the slit, find the total width of the central maximum, wavelength of light used is 5000 \AA . (5)

5. (a) A set of 8 tuning forks is arranged in a series of increasing frequencies. If each fork gives 4 beats per second with the preceding one and the frequency of the last fork is an octave of the first, find the frequencies of the first and the last fork. (5)
- (b) Give Stokes treatment of reflection and refraction. (5)
- (c) A parallel beam of light of wavelength 5890 \AA is incident on a glass plate ($\mu=1.5$) such that the angle of refraction into the plate is 60° . Calculate the smallest thickness of the plate which will make it dark by reflection. (5)

[This question paper contains 4 printed pages]

Your Roll No.



Sr. No. of Question Paper : 4023

Unique Paper Code : 2232522401

Name of the Paper : Fundamentals of Human Physiology

Name of the Course : B.Sc. (Prog) Life Sciences

Semester : IV (DSC)

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **FOUR QUESTIONS** in all and **QUESTION NO. 1** is **COMPULSORY**.
3. Draw Well labelled diagram wherever necessary.

1. (a) Define following (**Any three**): (3)

(i) Chyme

(ii) Sinoatrial (SA) node

(iii) Glomerular filtration rate (GFR)

(iv) Lung compliance

P.T.O.

(b) Differentiate between the following. (6)

- (i) Primary active transport and secondary active transport.
- (ii) Action potential and Graded potential.
- (iii) Spermiogenesis and spermatogenesis.

(c) Give the location and function of the following : (3)

- (i) Papillary muscles
- (ii) Chief cells
- (iii) Gonadotrophs

(d) State whether the statement is true or false. (3)

- (i) The oxytocin and antidiuretic hormone (ADH) are synthesized by posterior pituitary.
- (ii) Pepsinogen is converted to pepsin by the action of HCl secreted from parietal cells.
- (iii) A rightward shift in the O_2 -Hb saturation curve indicates decreased affinity of hemoglobin for oxygen, making it easier for oxygen to dissociate from hemoglobin.

2. (a) Explain chemical digestion and absorption of proteins with detailed account of enzymes involved. (8)
- (b) Draw ultrastructure of a sarcomere and briefly discuss three classes of proteins of a sarcomere. (7)
3. (a) Explain the O_2 -Hb dissociation curve? Describe various factors affecting this curve. (8)
- (b) Describe origin and conduction of action potential in myelinated and non-myelinated nerve fiber. Which of the conduction is more efficient and why? (7)
4. (a) Give a detailed account of the events occurring during menstrual cycle along with hormonal control. (10)
- (b) Describes events of a cardiac cycle in detail. (5)
5. (a) Explain the process of origin and conduction of cardiac impulse. (6)
- (b) Give a detailed account of the factors responsible in regulating of glomerular filtration rate (GFR). (9)

6. Write a short note on any **three** of the following :
(5×3=15)

(a) Excitation-Contraction coupling

(b) Chloride shift

(c) Counter-current Mechanism

(d) Transport of Carbon dioxide

[This question paper contains 4 printed pages.]

Your Roll No.



Sr. No. of Question Paper : 4038

Unique Paper Code : 2173552001

Name of the Paper : DSE: Main Group Chemistry

Name of the Course : B.Sc. (Prog.)

Semester : IV

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Answer any **four** out of **six** questions.
3. **All** questions carry equal marks.

1. (i) What are standard electrode potentials (SEP)?
What are the categories in which metals are divided based on SEP?

P.T.O.

- (ii) What do you understand by 3 centre - 2 electron bond? Explain with the help of a suitable example.
- (iii) Why is carbon used as the most common reducing agent? What are the drawbacks of using carbon as a reducing agent? (5,5,5)
2. (i) What is a crypt? Draw the structure of complexes formed by crypt with group 1 metals. Give its applications.
- (ii) Why and in what ways does Beryllium show anomalous behaviour than rest of the elements of group 2?
- (iii) What are the inorganic polymers? How do they differ from organic polymers? (5,5,5)
3. (i) Write the reaction for the preparation of Borazine from diborane and ammonia. Explain its structure and show its similarity with benzene.
- (ii) Differentiate between o-phosphoric acid and o-phosphorous acid.

(iii) Why HF is weak acid in water though HF has a greater electronegativity difference than the other hydrides. (5,5,5)

4. (i) Why is the second Ionization Energy of Alkali Metals extremely high? Name the factors that influence the Ionization Energy.

(ii) What is the chemical name of 'HYPO'. Give its structure and chemical reaction with b and one application area.

(iii) What are pyroxenes and amphiboles? Give basic composition and structure of each. (5,5,5)

5. (i) What is the difference between minerals and ores? Comment on the process of smelting.

(ii) Explain van Arkel de Boer's process for the purification of zirconium. Write down its limitations also.

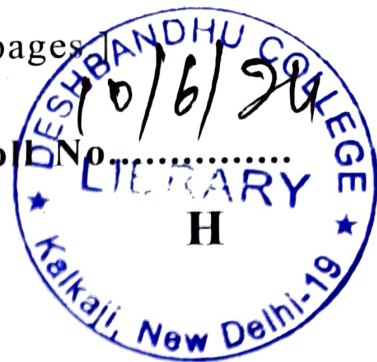
(iii) Why H_2O has maximum density at $4^\circ C$.

(5,5,5)

6. (i) Give the hybridization and structure of PCl_5 .
- (ii) Arrange the following acids in decreasing order of acidic strength. Justify your answer.
- (i) HClO_3 , HClO , HClO_4 , HClO_2
- (ii) H_3PO_4 , H_3PO_2 , H_3PO_3
- (iii) Draw structure of Caro's and Marshall's acid.
- (5,5,5)

[This question paper contains 4 printed pages]

Your Roll No.



Sr. No. of Question Paper : 4045

Unique Paper Code : 2173522006

Name of the Paper : DSE : Biomolecules – I

Name of the Course : **B.Sc. (Prog.)**

Semester : IV

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
 2. Attempt any **four** questions out of **six**.
 3. **All** questions carry equal marks.
 4. Attempt **all** parts of a question together.
-
1. (a) Give the mechanism of osazone formation for D-glucose. D-Glucose and D- Fructose give the same osazone. Explain.

P.T.O.

- (b) Distinguish between reducing and non-reducing sugars. Draw the Fischer projection and Haworth projection structure of anomers of glucose and fructose.
- (c) Give the biological functions of lipids? (5,5,5)
2. (a) Convert the following :
- (i) D-Fructose to D-Glucose
 - (ii) D-Glucose to D-Arabinose
- (b) What are nucleotide and nucleoside? Give the name and draw the structure of nucleotide & nucleoside having adenine as a base found in DNA.
- (c) Write a short note on oil and fats.
- (d) What are biochemical functions of steroid hormones? (4,3,4,4)
3. (a) Outline a sequence of reaction by which Maltose can be converted into 2,3,4,6- Tetra-O-methyl-D-glucose and 2,3,5,6-Tetra-O-methyl-D-gluconic acid. Draw all the configurational structures.

(b) What is RNA? Briefly explain the three functional types of RNA.

(c) What is rancidity? Differentiate between oxidative and hydrolytic rancidity. (5,5,5)

4. (a) What product will be formed when glucose is

(i) reacted with HCN.

(ii) reacted with phenyl hydrazine.

(iii) reacted with dil. HNO_3 .

(iv) heated with HI in presence of phosphorus.

(v) reduced with sodium-alcohol.

(b) What are epimers? Explain using suitable examples. Suggest a method to convert D-(+)-Glucose to D-(+)-Mannose.

(c) Define iodine number. What is its significance. Calculate the iodine number of triolein whose molecular weight is 884.

(d) What are liposomes and how are they utilized in various fields? (5,3,3,4)

5. (a) β -D-glucose and α -D-glucose have different specific rotations. When either anomer is dissolved in water, their rotation change until a fixed value results. Name the term used to describe this change and discuss the mechanism.
- (b) Briefly explain the various components present in nucleic acids.
- (b) Write a note on hydrogenation of oil. (5,5,5)
6. (a) Draw the structures of disaccharide sucrose and lactose. How is the nature of linkages between 2 monosaccharide units established?
- (b) Write short note on :
- (i) Cellulose
 - (ii) Omega-3 and Omega-6 fatty acids
 - (iii) Lipid Membranes
- (c) Give the biological importance of triglycerides. (4,6,5)

[This question paper contains 4 printed pages]

Your Roll No.



Sr. No. of Question Paper : 4269

Unique Paper Code : 2173542003

Name of the Paper : DSE : Conductance,
Electrochemistry and
Chemical Kinetics

Name of the Course : **B.Sc. (Prog.) Analytical
Chemistry**

Semester : IV

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **four** questions in all. Question No. **1** is compulsory.
3. **All** questions carry equal marks.
4. Attempt all parts of a question together.
5. Use of non-programmable scientific calculator is allowed.

1. Explain briefly any **five** of the following :

(a) What is the role of salt bridge in galvanic cells?

P.T.O.

- (b) Can a solution of 1M copper sulphate be stored in a vessel made of Nickel metal? Given that $E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25 \text{ V}$ and $E^\circ_{\text{Cu}^{2+}/\text{Cu}} = 0.34 \text{ V}$.
- (c) Metallic conductance decreases while electrolytic conductance increases with temperature.
- (d) Reactions of third and higher order are not very common.
- (e) Higher the activation energy of a reaction, slower is the rate of a reaction.
- (f) Define the term ionic mobility? Give its unit.
(5×3)
2. (a) (i) Write the integrated rate law equation for a second order reaction when the initial concentrations of both the reactants are same.
- (ii) Show that for a first order reaction the time required for 99.9% completion of the reaction is 10 times that required for 50% completion.
- (b) Give the mathematical expression of the Arrhenius equation and explain the terms involved.
- (c) Briefly describe any one method to determine the order of the reaction.
(6,5,4)

3. (a) What is meant by transference number of an ion?
The molar conductance at infinite dilution of KCl is $130.1 \text{ Scm}^2\text{mol}^{-1}$. The Hittorf number, t_- of Cl^- in very dilute solution is 0.505. Calculate the mobilities in of K^+ and Cl^- ions (Faraday's constant $F = 96500 \text{ C mol}^{-1}$).
- (b) How does molar conductivity vary with dilution for strong and weak electrolytes?
- (c) Discuss the titration curves obtained in the conductometric titration of CH_3COOH versus NaOH aqueous solutions. (5,5,5)
4. (a) For the following electrochemical cell
- $$\text{Fe}/\text{Fe}^{2+}(0.1\text{M})//\text{Cd}^{2+}(0.01\text{M})/\text{Cd}$$
- Write down the cell reaction and determine the EMF of the cell.
- Also indicate the direction of spontaneous cell reaction.
- (The standard electrode potential of Fe^{2+}/Fe half-cell is -0.44 V and that of Cd^{2+}/Cd is -0.40 V).
- (b) State the principal underlying the potentiometric titrations. What are the advantages of potentiometric titrations over volumetric titrations. Draw the potentiometric titration curve involving strong acid and strong base.

- (c) If the molar conductivities at infinite dilution of NaCl, HCl and CH_3COONa are 126.4, 426.1 and $91.0 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$, respectively, what will be the molar conductivity of acetic acid? (6,5,4)
5. (a) Derive an equation to determine the pH of a solution using glass electrode.
- (b) Give the expression of the free energy change (ΔG) accompanying a cell reaction using the EMF of a cell. Also derive the expressions of the enthalpy change (ΔH) and the entropy change (ΔS).
- (c) The rate constant of a second-order reaction is $5.70 \times 10^{-5} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 25°C and $1.64 \times 10^{-4} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 40°C . Calculate the activation energy and the Arrhenius pre-exponential factor. ($R=8.314 \text{ J K}^{-1}\text{mol}^{-1}$) (5,5,5)
6. Write short notes on any **three** of the following :
- (i) Reversible and irreversible galvanic cells
- (ii) Role of catalyst on the rate of a reaction
- (iii) Standard Hydrogen Electrode
- (iv) Michaelis-Menten mechanism of enzyme catalysis (5,5,5)



[This question paper contains 5 printed pages.]

Your Roll No.

Sr. No. of Question Paper : 4283
Unique Paper Code : 2353572006
Name of the Paper : Linear Programming
Type of the paper : DSE
Semester : IV
Programme : B.Sc. (Physical Science and Mathematical Science) with Operational Research

Duration : 3 hours

Maximum Marks : 90 Marks

Instruction for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt all question by selecting two parts from each question.
3. Part of the questions to be attempted together.
4. All questions carry equal marks.
5. Use of Calculator not allowed.

Q1 (a) Solve graphically the following linear programming problem

$$\text{Maximize } z = x - 2y$$

Subject to

$$x + y \leq 4$$

$$3x + y \geq 6$$

$$y \leq 2$$

$$x, y \geq 0$$

(7.5)

(b) Find the all basic feasible solutions of the following equations

$$2x_1 + 3x_2 + 4x_3 + x_4 = 6$$

$$x_1 + x_2 + 7x_3 + x_4 = 2$$

(7.5)

(c) Examine the convexity of the set $S = \{(x, y) \in \mathbb{R}^2, y^2 \leq 4x\}$.

(7.5)

Q2 (a) Use Simplex Method to solve the following Linear Programming Problem.

$$\text{Maximize } z = 4x_1 + 10x_2$$

Subject to

$$2x_1 + x_2 \leq 50$$

$$2x_1 + 5x_2 \leq 100$$

$$2x_1 + 3x_2 \leq 90$$

$$x_1, x_2 \geq 0$$

(7.5)

(b) Use Simplex Method to solve the following Linear Programming Problem.

$$\text{Maximize } z = 10x_1 + 5x_2$$

Subject to

$$4x_1 + 5x_2 \leq 100$$

$$5x_1 + 2x_2 \geq 80$$

$$x_1, x_2 \geq 0$$

(7.5)

- (c) Using Artificial variable technique Method, solve the following Linear Programming Problem.

$$\text{Minimize } z = x_1 - 2x_2 - 3x_3$$

Subject to

$$-2x_1 + x_2 + 3x_3 = 2$$

$$2x_1 + 3x_2 + 4x_3 = 1$$

$$x_1, x_2, x_3 \geq 0$$

(7.5)

- Q3 (a) Show that there is an unbounded solution to the following Linear Programming Problem.

$$\text{Maximize } z = 4x_1 + x_2 + 3x_3 + 5x_4$$

Subject to

$$4x_1 - 6x_2 - 5x_3 - 4x_4 \geq -20$$

$$-3x_1 - 2x_2 + 4x_3 + x_4 \leq 10$$

$$-8x_1 - 3x_2 + 3x_3 + 2x_4 \leq 20$$

$$x_1, x_2, x_3, x_4 \geq 0$$

(7.5)

- (b) Obtain the Dual of the following Linear Programming Problem.

$$\text{Minimize } z = x_1 + x_2 + x_3$$

Subject to

$$x_1 - 3x_2 + 4x_3 = 5$$

$$x_1 - 2x_2 \leq 3$$

$$2x_2 - x_3 \geq 4$$

(7.5)

$$x_1, x_2 \geq 0, x_3 \text{ is unrestricted}$$

- (c) A person requires 10, 12 and 12 units of chemicals A, B and C respectively for his garden. A Liquid product contains 5, 2 and 1 units of A, B and C respectively per jar. A dry product contains 1, 2 and 4 units of A, B and C per carton. If the liquid product sells for Rs 3 per jar and the dry product sells for Rs. 2 per carton, how many of each should he purchase in order to minimize the cost and meet the requirement? Give the Mathematical Formulation of the problem.

(7.5)

- Q4 (a) Solve the following transportation problem.

(7.5)

Warehouse	I	II	III	IV	Supply
w ₁	3	4	5	6	6
w ₂	2	4	4	3	10
Demand	4	6	8	6	

- (b) A Company has four warehouses, a, b, c and d. It is required to deliver a product from these warehouses to three customers A, B and C. The warehouses have the following amounts in stock.

Warehouse:	a	b	c	d
No. of units:	150	40	180	170

and the customer's requirements are

Customer's	A	B	C
No. of units	200	180	110

The table below shows the costs of transporting one unit from warehouses to the customer's.

	a	b	c	d
A	20	25	28	31
B	32	28	32	41
C	18	35	24	32

Find the optimal schedule and minimum total transport cost. (7.5)

- (c) For the following Cost minimization problem. Find initial basic feasible solution by using North-West corner rule, Least Cost method and Vogel's approximation method. compare the three solutions. (7.5)

	A	B	C	D	Supply
I	19	14	23	11	11
II	15	16	12	21	13
III	30	25	16	39	19
Demand	6	10	12	15	

- Q5 (a) A department head has four tasks to be performed and three subordinates, the subordinates differ in efficiency. The estimates of the time, each subordinate would take to perform task, is given below. How should he allocated the tasks one to each subordinate, so as to minimize the total man-hours? (7.5)

Subordinate	1	2	3
I	9	26	15
II	13	27	6
III	35	20	15
IV	18	30	20

- (b) A Company is faced with the problem of assigning six different machines to six different jobs. Determine the optimum assignment schedule. The cost is estimated as follows. (7.5)

	a	b	c	d	e	f
1	31	62	29	42	15	41
2	12	19	39	55	71	40

3	17	29	50	41	22	22
4	35	40	38	42	27	33
5	19	30	29	16	20	23
6	72	30	30	50	41	20

- (c) Five teachers are capable of teaching anyone of the 5 different subjects. Class preparation time-hours for different topics varies from teacher to teacher and is given in the table below. Each teacher is assigned only one topic so as to minimize the total course preparation time for all the topics. (7.5)

	I	II	III	IV	V
A	11	17	8	16	20
B	9	7	12	6	15
C	13	16	15	12	16
D	21	24	17	28	26
E	14	10	12	11	15

- Q6 (a) Solve the game matrix $A = \begin{bmatrix} 0 & -2 & -1 & 0 \\ 3 & 5 & 6 & -1 \\ 5 & -1 & -3 & -2 \end{bmatrix}$ using dominance. (7.5)

- (b) Find the range of values p and q so that the entry (2,2) is a saddle point in the following games

$$\begin{array}{c}
 \text{Player B} \\
 B_1 \quad B_2 \quad B_3 \\
 \text{Player A} \quad A_1 \begin{bmatrix} 2 & 4 & 5 \\ A_2 \begin{bmatrix} 10 & 7 & q \\ A_3 \begin{bmatrix} 4 & p & 6 \end{bmatrix}
 \end{array}
 \end{array}
 \quad (7.5)$$

- (c) Find the solution of the following payoff matrix, graphically:

$$A = \begin{bmatrix} -1 & 7 \\ 4 & -1 \\ 2 & 1 \\ 3 & -2 \end{bmatrix}
 \quad (7.5)$$