[This question paper contains 2 printed pages.]

Roll No.....

E

Sr. No. of Question Paper : 5025

Unique Paper Code : 32173910

Name of the Paper : Chemistry of Cosmetics and Perfumes

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

Semester : IV/VI

Duration : 2 Hours Maximum Marks : 38

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. Question No. **1** is compulsory. Attempt any **three** other questions from the remaining **four** questions.

1. (a) Classify the cosmetics on the basis of body parts?

(b) Explain the difference between vanishing creams and cold creams.

(c) Name and discuss the role of preservatives and antiseptic agent used in the preparation of medicated powder.

(d) What is the role of ammonia or any amine compound in the preparation of permanent hair dye ?

P.T.O.

(e) Give full form of INCI and BIS. (3×4,2)

2. (a) Define SPF? Explain the significance of SPF30, SPF60 and SPF95 with reference to sunscreen cream.

(b) What is the function of nitrocellulose, cetyl alcohol, pigments and lanolin in nail lacquer formulation? (4,4)

3. (a) What are Deodorants? Discuss are the role of main ingredients of deodorants.

(b) What are the different types of shampoo? What is the role of hair conditioners? (4.4)

4. (a) What are flavors? Discuss the different types of flavouring substances.

(b) What is the difference between tooth paste and tooth powder? Write the formulation of tooth powder. (4,4)

5. Write short notes (**any two**) :

(a) Lipsticks

(b) Antiperspirants

(c) Essential Oils

(d) Types of Skin (4,4)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5629 **E**

Unique Paper Code : 42343602

Name of the Paper : PHP Programming

Name of the Course : **B.Sc. (Program) / B.Sc. Mathematical Science : SEC**

Semester : VI

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. **Q.1** is compulsory.
3. Attempt any **three** questions from **Q2** to **Q7**.

1. (a) List four features of PHP. (2)

(b) How do we create a constant in PHP? Declare a constant with name *flower* and value *Rose*. (2)

(c) What will be the output of the following code : (2)

```
<?php
    $a =10;
    $b = 0;
    $val = $a && $b;
    echo ($val ? 'TRUE' : 'FALSE'),"\n";
    $val = $a and $b;
    echo (Sval ? 'TRUE' : 'FALSE');
?>
```

(d) Write PHP command to connect to a MySQL server with address "127.8.8.1". (2

(e) Whatis the difference between substr() and strstr() functions? Explain with an example of each. (2

2. (a) What is the purpose of using $_POST[]? Explai its usage with an example. (3

(b) Write PHP script to delete a record from the tabl *Qppr(UPC integer, ppr_title varchar(2))* wher UPC is *42343602*. (2

3. What is a regular expression? Why do we requir them? Create an HTML form containing Name an Phone number. Using regular expressions, (5

(i) Check whether the entered name starts with an "A" or not.

(ii) Phone numbers should follow the format "xxx-xxxxxx" where x is a number.

4. (a) What will be the output of the following code : (2)

```
<?php
function increment(&$a)
        { ++$a; }
function decrement($a)
        { --$a; }
$val = 10;
echo "Value is = $val <br>";
increment($val);
echo "Value after incrementing is = $val <br>";
decrement($val);
echo "Value after decrementing is $val <br>";
?>
```

(b) What is difference between an associative array and an indexed array? Explain with the help of an example. (3)

5. Create an HTML form that gets *Name of employee* and *Basic salary* entered by user in text boxes. Write PHP functions to perform the following calculations : (5)

   (i) Calculate DA-

   (a) DA is 5% of basic salary if basic is less than 10000.

   (b) DA is 10% of basic salary if basic lies between 10000 and 15000.

   (c) DA is 15% of basic salary if basic is greater than 15000.

   (ii) Calculate HRA-
   HRA is 20% of DA.

   (iii) Total Salary is sum of basic, DA and HRA

6. What is meant by three tier web application development? What is the role of PHP in web application development? (5)

7. Explain the following functions with a suitable example :

   (a) ucwords() (b) implode()

   (c) substr_replacc() (d) die()

   (e) stripslashes() (5)

(1000)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5630 **E**

Unique Paper Code : 42353605

Name of the Paper : SEC-4: Statistical Software-R

Name of the Course : **B.Sc. Mathematical Sc. / B.Sc. (Prog.)-CBCS (LOCF)**

Semester : VI

Duration : 2 Hours Maximum Marks : 38

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt all **5** questions, selecting any **2** parts from each.
3. All commands should be written using language R.

1. **Total marks: (2×2=4)**

   (a) Read the following stem-and-leaf plot.

P.T.O.

The decimal point is 1 digit(s) to the right of the |

8 | 028

9 | 115578

10 | 1669

11 | 01

Now give the data as vector 'X' with R command. Also write the R command to find the five basic quartiles of the vector 'x'.

(b) Put the list of values 7, 5, 9, 2, 1, 8, 4, 2, 4, 8 into a variable 'y'. Give R commands to find the standard deviation of y and its decreasing arrangement.

(c) Write the R commands to enter the characters: Jan, Feb, Mar, Apr using the scan() command to get output: "Jan" "Feb" "Mar" "Apr".

(d) If data10=c("Jan", "Feb" ,"Mar", "Apr", "May", "Jun" ,"Jul", "Aug", "Sep", "Oct"). Write R commands to first index the characters of data 10 alphabetically, and then assign them as numbers.

2. **Total marks: 3×2 = 6**

(a) Write R commands for the data frame 'df' and its transpose.

	Test1	Test2
1	45	56
2	67	82
3	76	69
4	58	48
5	91	73

Also name the rows: A, B, C, D, E and extract the second column.

(b) Make a list grass with data

mow : 12 15 17 11 15

unmow : 8 9 7 9

Also create a data frame grass 1 by using stack() command and name the columns as 'rich' and 'graze'.

(c) Create a vector in R as

X: 6.2 7 8.5 7 6.1 3.8 8 9 10

Also give R commands for converting X into integers, and the Tukey summary values.

P.T.O.

(d) Put the following values: 3,5,7,3,2,6,8,5,6,9,4,5,7,3,4 in a variable 'y' using scan() command in R. Also give R commands for finding first five terms and the items less than 9 & more than 6 in the variable 'y'.

3. **Total marks: 4×2 = 8**

(a) Create a vector in R as

X: 6.2 7 8.5 7 NA 6.1 3.8 8 9 NA 10

Give R commands to find the mean, median, and convert the vector X into integers.

(b) Put the following values into variable y: 3, 5, 7, NA, 2, 6, 8, 6, 9, 4, 5, 7, 3, 4, NA

Give R commands to find first five terms, the position of minimum item of 'y', and items less than 9 & more than 6.

(c) Give R command to form a 3×3 matrix :

$$\begin{pmatrix} 50 & 70 & 90 \\ 45 & 56 & 67 \\ 55 & 60 & 81 \end{pmatrix}$$

with row names : Mathematics, English, Physics and column names: S1, S2, S3, respectively.

(d) Write R command for a 3×3 matrix M:

	ENG	MATH	PHY
Suraj	24	28	25
Tanvi	18	19	20
Rahvi	20	23	16

Give R commands to print marks of Tanvi in all subjects. Also change row names to S1, S2 and S3, respectively.

4. **Total marks: 5×2 = 10**

Giving R command to make a data frame 'dfs' of two-column with a response variable (flower) and a predictor variable (site) :

flower	9	7	1	10	2	5	4	7	6	7	3	4	5	3	5	6	4	6
site	A	A	B	A	B	C	B	B	B	C	B	B	B	C	B	C	B	A

Write R commands for any two of the following :

(a) Produce a histogram and also overlay a density plot of blue color having line width 2 units with gaussian kernel for the site 'B' only.

(b) Produce a histogram for 50 random normal variates data with mean and standard deviation from data in part (a), and also overlay two density plots of data one from part (a) and second from 50 normal variates with gaussian kernel, use different colors and line types.

(c) Shapiro-Wilk normality test and normal quantile-quantile plot with a straight line for the site 'B' only. Also using apply family command to produce Shapiro-Wilk normality test for the site 'A', 'B' and 'C' respectively.

(d) Create a Portable Network Graphics image of size 650 × 450 pixels to draw a box-whisker plot of the data frame 'dfs' using light green color.

5. Total marks: 5×2 = 10

Giving R command to make a data frame 'df' with data :

Write R commands for any **two** of the following :

(a) To draw a scatter plot of data points (x, y) using gray color symbol '+' of 2 units size and axis labels with limits each 0 to 22. Also add a line of best fit for the data.

(b) Make a single vector 'rain' from x values of the data frame 'df' to draw a bar chart with month as names for the bars. Also label axes as 'month' and 'rainfall cm' with y limits 0 to 20 and draw gray color thin dashed horizontal lines at 0, 5, 10, 15, 20.

(c) Make a single vector 'rain' from x values of the data frame 'df to draw a pie chart clockwise with month as labels stating at 9 o'clock. Also set the colors to six shades of gray.

P.T.O.

(d) Make a single vector 'rain' from x values of the data frame 'df' to draw a Cleveland dot plot with month as labels. Also set the color to blue and plot character 20.

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5650

Unique Paper Code : 42344403

Name of the Paper : Computer System Architecture

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

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. Question No. **1** is compulsory.
3. Attempt any **5** of questions Nos. **2** to **9**.
4. Parts of a question must be answered together.

1. (a) Write the characteristic table of SR flip-flop. (2)

(b) Perform the following operations using signed-2's complement notation for negative numbers in 8-bit representation :

(i) +42 + (–13)

(ii) –42 – (–13) (2)

(c) Convert the following numbers to the indicated bases : (2)

(i) $(12121)_3$ to $(----)_{10}$

(ii) $(A675)_{16}$ to $(----)_8$

(d) Differentiate between selective-set and selective-clear. (2)

(e) What is Register? State the use of PC. (2)

(f) Consider the given micro-operation : (2)

M[AR] ← AC, SC ← 0

Write the name of given instruction and state its function.

(g) What is cycle stealing in DMA? (2)

(h) Draw the truth table and logic diagram of Half-Adder. (2)

(i) Specify the output of the following micro-operation : (2)

R3 ← R1 + (R2)' ← 1

(j) Expand the following terms : (2)

(i) CMOS

(ii) ASCII

(iii) TTL

(iv) ECL

(k) Write micro-operations for a following instruction in the basic computer : (2)

LDA (Load to AC)

(l) Construct an 8-to-1 -line multiplexer with two 4-to-1-line multiplexers and one 2 to-1-line multiplexer. Use block diagrams for the three multiplexers. (3)

2. (a) Simplify the following function in Sum-Of-Products (SOP) form using K-map. Also draw the logic diagram.

$F(P, Q, R, S) = \Sigma(0, 2, 5, 7, 8, 10, 11, 12, 14)$

$d(P, Q, R, S) = \Sigma(4, 6)$ (6)

(b) Given the following Boolean function : (4)

$F = A'B + ABC' + ABC$

(i) Simplify the given function F using Boolean algebra.

(ii) Find complement of F using DeMorgan's theorem.

3. (a) A two-word instruction is stored in memory at an address designated by the symbol W. The address field of the instruction (stored at W + 1) is designated by the symbol Y. The operand used during the execution of the instruction is stored at an address symbolized by Z. An index register contains the value X. State how Z is calculated from the other addresses if the addressing mode of the instruction is

(i) direct

(ii) indirect

(iii) indexed (6)

(b) Draw the logic diagram of a 2-to-4-line Decoder with only NOR gates including an enable input. (4)

4. (a) Design a combinational circuit with three inputs a, b, c and three outputs P, Q, R. When the binary input is 0, 1, 2 or 3, the binary output is one greater than the input; otherwise, the binary output is one less than the input. (6)

(b) Obtain the 9's complement of the following 8-digit decimal numbers :

(i) 90009951

(ii) 12349876 (2+2)

5. (a) Explain the functioning of a DMA Controller with the help of a block diagram. (6)

(b) A computer has 32-bit instructions and 12-bit addresses. If there are 250 two-address instructions, how many one-address instructions can be formulated? (4)

6. (a) What is the use of Binary Counter? Draw the 4-bit synchronous binary counter. (2+4)

(b) What is Programmed I/O? Specify any one method that can avoid the drawback of programmed I/O. (4)

7. (a) Design a 4-bit Binary Adder-Subtractor circuit diagram using full-adders. (6)

(b) Consider the following Registers with given values :

$R1 = (00110101)_2$

$R2 = (01100111)_2$

$R3 = (10111001)_2$

$R4 = (11101010)_2$

Determine the 8-bit binary representation of values in each register after the execution of the following sequence of operations. Perform the following operations using R1, R2, R3 and/or R4.

(i) $R1 \leftarrow R1 \oplus R2$

(ii) $R3 \leftarrow R4 - R3$ (4)

8. (a) A computer uses a memory unit with 512K words of 3 2 bits each. A binary instruction code is stored in one word of memory. The instruction has four parts: an indirect bit, an operation code, a register code part to specify one of 64 registers, and an address part. (6)

(i) How many bits are there in the operation code, the register code part, and the address part?

(ii) Draw the instruction word format and indicate the number of bits in each part.

(iii) How many bits are there in the data and address inputs of the memory?

(b) List the micro-operations for Fetch and Decode Phase of Instruction Cycle. (4)

9. (a) Draw the block diagram for the hardware that implements the following :

$$x + yz : AR \leftarrow AR + BR$$

where AR and BR are two n-bit registers and x, y and z are the control variables. Include the logic gates for the control function. (6)

(b) Write a program to evaluate the arithmetic statement:

$$X = (A+B) * (C+D)$$

using two address and three address instructions. (4)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5652 **E**

Unique Paper Code : 42174404

Name of the Paper : Chemistry of s and p block elements, States of matter and Chemical Kinetics

Name of the Course : **B.Sc. Physical Science/Life Science**

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 **six** questions in all, **three** questions from **SECTION A** and **three** questions from **SECTION B**.
3. Use separate answer sheets for **Section A** and **Section B** and indicate the section you are attempting by putting a heading of Section.
4. The questions should be numbered in accordance to the number in the question paper.
5. Use of Scientific Calculator is permitted.

P.T.O.

SECTION – A

(Inorganic Chemistry)

Attempt any **three** *questions from this section.*

1. (a) What is Ellingham's diagram? CO is better reducing agent than carbon below 710°C but above this temperature reverse is true. Explain. (4.5)

(b) Discuss the cyanide process of purification w.r.t silver metal. (4)

(c) What is diagonal relationship? Give reasons why it arises in Beryllium and Aluminium. (4)

2. (a) How NH_2OH is used in the preparation of nylon-6. Give the chemical reaction involved. (4.5)

(b) Compare the reducing power of H_3PO_4, H_3PO_3 and H_3PO_2. Give reason for your answer. (4)

(c) Graphite cleaves readily between layers. Explain. (4)

3. (a) What is inert pair effect? PbO_2 is an oxidizing agent. Explain. (4.5)

(b) Why excessive use of Phosphates as water softener is criticized by the environmentalists? (4)

(c) Complete any **four** reactions : (4)

(i) $H_2S_2O_7 + H_2O \rightarrow$

(ii) $N_2H_4 + O_2 \rightarrow$

(iii) $2ClO_2 + 2NaOH \rightarrow$

(iv) $CaC_2 + 2H_2O \rightarrow$

4. (a) Why the second ionization enthalpy of alkali metals is extremely high? Name the factors that influence the ionization energy. (4.5)

(b) Sulphur when heated melts to a mobile liquid, but on further heating the viscosity increases sharply and then decreases again. Explain. (4)

(c) Draw the structures/Shapes of the following compounds : (4)

N_2H_4, SO_2Cl_2, NH_3, PCl_5

SECTION – B

(Physical Chemistry)

Attempt **three** *questions from this section.*

$R = 8.314 \text{ J K}^{-1}\text{mol}^{-1}$

$k = 1.38 \times 10^{-23} \text{ J K}^{-1}$

$N_A = 6.023 \times 10^{23}$

5. (a) Roughly sketch the Maxwell distribution curve for the gas molecules in terms of molecular speeds. Label both axes and explain the effect of temperature on the distribution curve. (3.5)

(b) What are Miller indices? Calculate miller indices for planes having Weiss indices : (3)

(a) 2a, 3b, c (b) 2a, –3b, –3c

(c) Explain the dependence of surface tension on temperature and why the surface tension of a liquid becomes zero at its critical temperature. (3)

(d) Differentiate between order and molecularity of a reaction giving examples. (3)

6. (a) Describe the reasons for deviation of gases from ideal behaviour. Derive van der Waals equation of state for a real gas. (4)

(b) Calculate the collision number, Z_1 and mean free path, λ, of oxygen gas at 1 atm pressure and 27°C. The collision cross-section is 0.27 $(nm)^2$. (4)

(c) What do you understand by the term viscosity? What are its units? Describe the Ostwald viscometer method for the measurement of viscosity of a liquid giving expression. (4.5)

7. (a) Explain the concept of activation energy of reaction. Derive expression for its calculation from Arrhenius equation. (4)

(b) The density of Li metal is 0.53 g cm^{-3} and the separation of (100) planes is 350 pm. 4 Determine whether the lattice is f.c.c. or b.c.c. M(Li) = 6.941 g mol^{-1}. (4)

(c) Derive expression for Bragg's Law sketching labeled diagram and explain the significance of n in the equation. (4.5)

8. (a) Describe any two methods for determination of order of a reaction. (4)

(b) The rate constant for a second order reaction is 5.7×10^{-5} dm^3 mol^{-1} s^{-1} at 25°C and 1.64×10^{-4} dm^3 mol^{-1} s^{-1} at 40°C. Calculate the activation energy of the reaction. (4)

P.T.O.

(c) The half-life of the homogeneous gaseous reaction: $SO_2Cl_2 \rightarrow SO_2 + Cl_2$, which obeys first-order kinetics, is 8 minutes. How long will it take for the concentration of SO_2Cl_2 to be reduced to 1% of the initial value? (4.5)

[This question paper contains 12 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5654

Unique Paper Code : 42341202

Name of the Paper : Database Management Systems

Name of the Course : **B.Sc. (Prog.) Physical Science with Computer Science / B.Sc. (Prog.) Mathematical Science**

Semester : II

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. **Section A** is compulsory.
3. Attempt any **5** questions from **Section B**.

Section A

1. (a) Give two responsibilities of each of the following : (3)

(i) DBA (Database Administrator)

(ii) database designers

(b) An EMPLOYEE table has following two attributes Emp_Id and Emp_Name. Write an SQL statement to insert a new attribute Emp_Address to the EMPLOYEE table. (3)

(c) Identify multivalued, composite and complex attributes the following expression : (3)

Address_EmPhone({*Email*}, [*Phone*], *Address* (*House, number, street, city, state*))

(d) Write and draw the symbols used in Entity Relationship diagram for the following : (3)

(i) To represent multi-valued attribute

(ii) To represent derived attribute

(iii) To represent weak entity type

(e) For the given table, write down its degree, cardinality and identify any one candidate key. (3)

Emp – Ssn	Emp – Name	Date_of_Birth	Telephone
ES1	Smith John	11/03/1999	9999999988
ES2	Hood Robert	12/06/1987	9988999988
ES3	Brit Paul	12/04/1997	8889999999

(f) What is data redundancy? What are the disadvantages of having redundancy within a database? (3)

(g) What is the difference between logical data independence and physical data independence? (3)

(h) What is meant by an entity relationship (E-R) model? Explain the terms Entity, Entity type, and Entity set in DBMS (Database Management System). (4)

Section B

2. Consider the relational schema given below : (10)

STUDENT (ROLL_NO, S_NAME, BATCH_YR, PH_NO, COURSE_CODE)

COURSE (COURSE_CODE, COURSE_NAME, DEPARTMENT)

RESULT (ROLL_NO, C_CODE, TOTAL_MARKS)

A. Write the 'Create table' **commands in SQL** for STUDENT and RESULT table. Ensure the use of INTEGER and STRING data types, NOT NULL constraint, PRIMARY KEY constraint, FOREIGN KEY constraint at least once.

B. Write the following SQL queries based on the above relation schema :

(i) Retrieve all the student records whose name starts with the letter 'M' or 'R'.

(ii) Count the total number of students in a COURSE

(iii) Retrieve the TOTAL_MARKS of student with name 'XYZ'.

3. (a) List two main characteristics of the database approach and how it is different from the traditional file systems. (4)

(b) Consider the following schema : (6)

STUDENT (SID, SNAME, GENDER)

SUBJECT (SUBID, FACULTY)

ENROLLED (SID, SUBID)

Write the relational algebra queries for each of the following :

(i) Display *SNAME* and *GENDER* of the student having SID equal to 2.

(ii) Display all details of the *SUBJECT* having SUBID as 720 or 340.

(iii) Display SNAME of the students taking a SUBJECT taught by *'Roger'*.

4. (a) Explain entity integrity and referential integrity constraints. What is the importance of each constraint? (4)

(b) What is the cardinality (1: 1 / 1: N / M: N) for each of the following binary relationships based on the meaning of the entity types? Justify your answer. (6)

(i) Subject and Textbook

(ii) Class and Instructor

(iii) Student and Class

5. (a) What is the function of the following SQL statements? (4)

(i) on delete set null

(ii) on update cascade

(b) Consider the following relation *R*, which has attributes that hold schedules of courses and sections at a university; (6)

R = {*Course_no, Sec_no, Offering_dept, Credit_hours,* $Course_{level}$, $Instructor_{ssn}$, *Semester, Year, Days_hours, Room_no, No_of_students*}

The following functional dependencies hold on *R* :

{*Course_no*} → {*Offering_dept, Credit_hours, Course_level*}

{$Course_{no}$, Sec_{no}, *Semester, Year*} → {*Days_hours, Room_no, No_of_students, Instructor_ssn*}

P.T.O.

{Room_no, Days_hours, Semester,}

→ {Instructor_ssn, Course_no, Sec_no}

(i) Determine which sets of attributes form keys of R.

(ii) Normalize the above relation *R* upto 3NF.

6. (a) Observe the following two union-compatible relations R and S. Give the output of the SQL queries given below : (4)

R

RollNo	SName	*Course*
1012	Smith	CS
1013	Lily	PBU
1014	John	AP

S

EmpCode	EName	Dept
2212	Ria	Sales
2213	Smith	Accounts
2214	Amit	Marketing

(i) Select SName from R UNION Select EName from S

(ii) Select SName from RINTERECT Select EName from S

(b) Consider the following relation : (6)

STUDENT (RollNo, SName, Marks, Attendance, Course)

Rollno	SName	Marks	Attendance	Course
1	Smith	95	30	B.A
2	Paul	70	33	B.Sc.
3	James	90	40	B.A
4	John	85	32	B.A
5	Lizza	75	29	B.Sc.

Give the output of the following :

(i) Select *max(Marks)* from STUDENT group by Course.

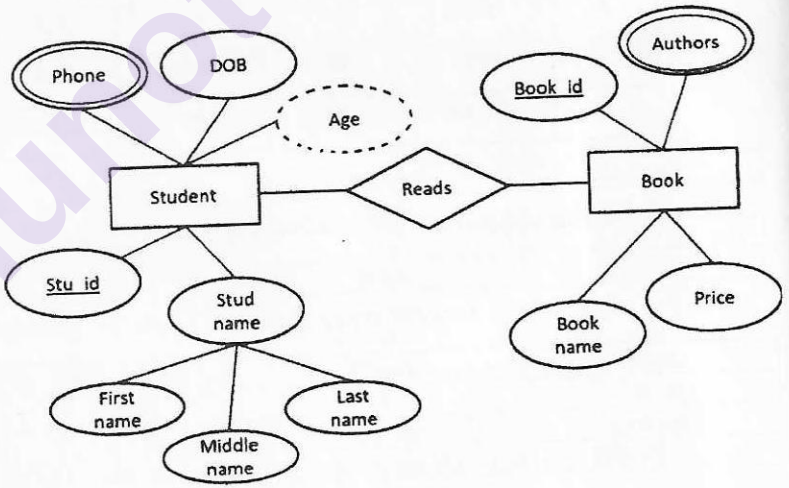
(ii) Select *SName, Marks, Attendance* from STUDENT where *Course = 'B.A.'*

P.T.O.

(iii) Select *SName* from *STUDENT* where attendance between 30 and 40.

7. (a) What is specialization? Give an example for disjointedness constraint. (3)

(b) Map the given ER Diagram to Relational model. (7)



8. Consider a MOVIE database in which data is recorded about the movie industry. The data requirements are summarized as follows : (10)

(i) Each movie is identified by title, year of release, length in minutes. Each movie has a production company and is classified under one or more genres (such as horror, action, drama and so forth). Each movie has one or more directors and one or more actors appear in it. Each movie also has a plot outline.

(ii) Actors are identified by name and date of birth and appear in one or more movie. Each actor has a role in the movie.

(iii) Directors are also identified by name and date of birth and direct one of more movies.

(iv) Production companies are identified by name and each has an address. A production company produces one or more movies.

Design an entity-relationship diagram (ERD) for the movie database. (Specify the entities, attributes, relationships, cardinality ratio and participation constraints in the ERD).

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5656

Unique Paper Code : 42171205

Name of the Paper : Core: Chemical Energetics Equilibria & FunctionalGroup Organic Chemistry -I

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

Semester : II

Duration : 3 Hours

Maximum Marks : 75
(Each Section: 37.5)

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Use Separate answer sheets for Sections A and B.
3. Use of Scientific Calculator is permitted. Log table will be provided.

SECTION – A

(Physical Chemistry)

Attempt any **three** questions.

1. (a) Determine the pH of a solution obtained by mixing equal volume of 0.1 M ammonium nitrate and 0.02

P.T.O.

M ammonium hydroxide, K_b for NH_4OH being 1.8 x 10^{-5}.

(b) Show that for adiabatic expansion of an ideal gas

$$TV^{\gamma-1} = Constant$$

(c) Show that the degree of hydrolysis of a salt of weak acid and weak base is independent of the concentration of the solution and derive the following equation

$$pH = -\frac{1}{2}[\log K_a + \log K_W - \log K_b]$$

$(4,4,4\frac{1}{2})$

2. (a) Differentiate between the following with the help of suitable examples:

(i) Enthalpy of formation and Enthalpy of reaction.

(ii) Differential enthalpy of dilution and Integral enthalpy of solution.

(b) By applying Le Chatelier's principle to predict the effect of increase in concentration and pressure on the following reaction:

(i)

$$PCl_5(g) \leftrightarrow PCl_3(g) + Cl_2(g) \qquad \Delta H = -418.0\ KJ$$

$$N_2(g) + O_2(g) \leftrightarrow 2NO(g) \qquad \Delta H = +180.75\ KJ$$

(c) Using the bond enthalpy data given below, calculate the enthalpy change for the reaction

$$C_2H_4(g) + H_2(g) \longrightarrow C_2H_6(g)$$

Given data:

Bond	Bond enthalpy
C—C	336.81 kJ mol^{-1}
C==C	606.68 kJ mol^{-1}
C—H	410.87 kJ mol^{-1}
H—H	431.79 kJ mol^{-1}

$(4,4,4\frac{1}{2})$

P.T.O.

3. (a) Differentiate between extensive variables and intensive variables with suitable examples.

(b) The solubility of AgBr at 293 K is 1.84×10^{-6} moles/litre. Calculate the value of K_{sp}. Assuming the salt is completely dissociated.

(c) Derive the expression for the Van't Hoff reaction isotherm for the reaction

$$aA + bB \leftrightarrow mM + nN$$

Show that

$$\Delta G^{\circ} = -2.303\, RT \log K_p \qquad (4,4,4\tfrac{1}{2})$$

4. (a) Write short note on the following (any two):

(i) Third Law of thermodynamics.

(ii) Factors affecting the degree of ionization.

(iii) Common ion effect.

(iv) Hess's law of constant heat of summation.

(b) 10 moles of an ideal gas at the initial pressure of 1atmosphere at 0^0C were expanded reversibly under isothermal conditions to a final pressure of 0.1 atmosphere. calculate the value of q, w, ΔE and ΔH (R = 1.987 Cal deg^{-1} mol^{-1}).

$(4,4,4\tfrac{1}{2})$

SECTION – A
(Organic Chemistry)

Attempt any three questions from this section.

Q.No. 5 is compulsory.

5. (a) Bromination of nitrobenzene is difficult as compared to nitration of bromobenzene. Explain.

(b) Arrange the following chlorides in order of their increasing S_N^2 reactivity and explain the order:-

CH_3Cl CH_3CH_2Cl $(CH_3)_2CHCl$

P.T.O.

$(CH_3)_3CCl$ (3)

(c) Write down the order of reactivity of the following molecules towards Nucleophilic ← addition reaction

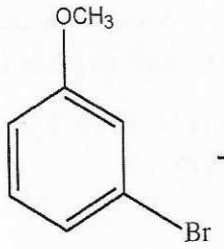
HCHO CH_3CHO CH_3COCH_3

Explain the order. (3)

(d) What happens when neopentyl alcohol is treated with HCl. Explain with mechanism. (3)

(e) p-Nitrophenol is more acidic than o-Nitrophenol. Explain. (1.5)

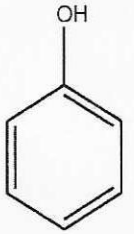
6. Complete the following reactions with mechanisms:-

(i) 

$\xrightarrow{KNH_2 / \text{Liq } NH_3}$?

(ii) $CH_3\text{-}O\text{-}CH(CH_3)_2 \xrightarrow[\text{Cold}]{HI}$?

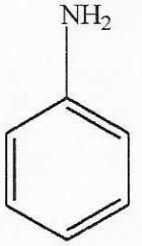
(iii) HCHO + PhCHO $\xrightarrow{NaOH}$?

(iv) 

$\xrightarrow[NaOH]{CHCl_3}$?

(3,3,3,3)

7. (a) Complete the following reactions and mention the name of reaction:-

(i) 

$\xrightarrow[\text{(ii) Cu powder/HCl}]{\text{(i) } NaNO_2/\text{ HCl}}$?

(ii) $CH_3COCH_3 \xrightarrow{Zn\text{-}Hg/HCl} ?$

(iii) $RCOCl + H_2 \xrightarrow{Pd/\ BaSO_4} ?$

(b) With the help of a suitable example, write down S_N^i mechanism.

(c) How will you distinguish between the following compounds:-

(i) Acetaldehyde & Acetone

(ii) Phenol & Ethanol

(6,2,4)

8. Write short note on any three of the following:-

(a) Meerwein Ponndorf Verley Reduction

(b) Friedel Crafts Alkylation

(c) Pinacol-Pinacolone Reaction

(d) Houben Hoesch Condensation

(4,4,4)

(300)

[This question paper contains 6 printed pages.]

Your Roll No......

Sr. No. of Question Paper : 5690

Unique Paper Code : 42353405

Name of the Paper : Sec-2 Mathematical Typesetting System: LaTex

Name of the Course : **B.Sc. Mathematical Science-CBCS: Skill Enhancement**

Semester : IV

Duration : 2 Hours Maximum Marks : 38

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **two** parts of each question.

1. (a) Create latex file use these environments title, section, subsection, subsubsection.

(b) Write input matrix environment command in latex :

P.T.O.

$$\begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}.$$

(c) Define preamble and Markup language. What is the extension file of the latex document? Write use package to include graphs in the latex file.

(d) Write latex code of the following :

$$\gamma^{(\Gamma(\eta+\lambda))}$$ (7)

2. (a) Write latex code of the following :

$$\begin{Bmatrix} \alpha = f(z) \\ \beta = f(z^2) \\ \gamma = f(z^3) \end{Bmatrix} \quad \text{and} \quad \begin{Bmatrix} x = \alpha^2 - \beta \\ y = 2\gamma \end{Bmatrix}$$

(b) What is the difference between \begin{equation}, \end{equation} and \begin {eqnarray}, \end {eqnarray}.

(c) Write correct LaTex code of the following :

$f(lambda x +(1- \lambda)y)\leq \lambda f(x)+(1- \lambda)f(y),

(d) What is the difference between the following commands in latex?

(i) \, and \:

(ii) \vdots and \hdots. (7)

3. Write the code in LaTex to get the following output : (4)

(a) $(x+a)^n \neq \sum_{k=0}^{n} a^{n-k}$.

(b) $(1+x)^n = 1 + \frac{nx}{1!} + \frac{n(n-1)x^2}{2!} + \cdots$.

(c) $\sqrt[3]{\frac{x}{y}} + \sqrt[2]{z}$.

(d) Consider the sets A_1, A_2, A_3,

then $A_1 \cap (A_2 \cup A_3) = (A_1 \cap A_2) \cup (A_1 \cap A_3)$.

4. Write the code in LaTex to get the following output : (8)

(a) If A_t is a given function of t then the difference equation

$$x_t = ax_{t-1} + A_t$$

has the solution

$$x_t = a^t x_0 + (a^{t-1}A_1 + a^{t-2}A_2 + \cdots + A_t).$$

P.T.O.

(b) Consider the problem: max $20x_1 + 30x_2$

$$\text{subject to } \begin{cases} 3x_1 + 6x_2 \le 150 \\ x_1 + 0.5x_2 \le 22 \\ x_1 + x_2 \le 27.5 \\ x_1, x_2 \ge 0 \end{cases}$$

(c) Consider

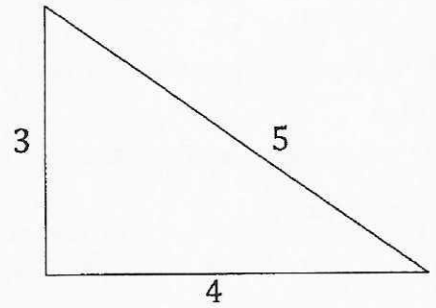
$$\int x^p \ln x \, dx = \frac{x^{p+1}}{p+1}\ln x - \frac{x^{p+1}}{(p+1)^2}\ln x + c \quad (p \neq -1)$$

(d) Write the LaTeX code to write the following :

$$A = \begin{bmatrix} a & b & c & d \\ e & f & g & h \\ i & j & k & l \\ m & n & o & p \end{bmatrix}.$$

5. (a) Write the command to draw an arc of a circle of radius 2.5 units centred at the point (2,2) making an angle of 45 degree.

(b) Write the command in PSTricks to draw the following picture.



(c) Write the command to draw a circle of radius 1.5 units centered at the point (3,2.5).

(d) Write the command in PSTricks to plot the functiony = $\sin\left(\frac{1}{x}\right)$. (6)

6. (a) Write a presentation in beamer with the following content :

Slide-1: Title: Prime Number

Step-1. There is No Largest Prime Number.

Slide-2: Title: Proof

Step-2. Suppose the number of primes is finite.

Slide-3: Title: Prime Number

Step-3. Let p be the number of all primes.

Slide-4: Title: Prime Number

Step-4. Then p + 1 is not divisible by any prime.

Slide-5:

Step-5. Therefore, p + 1 is also a prime, a contradiction.

P.T.O.

(b) Using beamer prepare a presentation with the following content :

Slide 1: Title of presentation with authors name and date

Slide 2: Some trigonometry identities:

$$\sin^2\alpha + \cos^2\alpha = 1$$

$$2 \sin\alpha \cos\alpha = \sin 2\alpha$$

Slide 3: Thank You

(c) Write a presentation in beamer with the following content:

Slide 1: Title: Real Number

Step-1. The set of real numbers is denoted by R.

Slide-2: Title: Greek Letters

Step-2. Let $\alpha = 3$, $\beta = 4$ and $\gamma = 5$.

Slide-3: Title: Triangle Inequality

Step-3. Triangle Inequality: $|\alpha + \beta| \leq |\alpha| + |\beta|$.

(d) What is beamer presentation? Write the four advantages of beamer. (6)

[This question paper contains 2 printed pages.] 18 MAY 2023

Your Roll No.....

Sr. No. of Question Paper : 5708 **E**

Unique Paper Code : 42161201

Name of the Paper : Plant Ecology and Taxonomy

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

Semester : II

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 and B** on SEPARATE SHEETS.
3. Question No. **1** of both sections is COMPULSORY.
4. Attempt **three** questions from **Section A** and **three** questions from **Section B** including question number **1** from both the sections.
5. Attempt **all** parts of a question together.

SECTION – A

1. (a) Define **any five** of the following: (5x1=5)
   i. Edge effect
   ii. Holard
   iii. Autogenic succession
   iv. Thermocline
   v. Community
   vi. Abundance

   (b) Fill in the blanks: (5x0.5=2.5)
   i. Instrument used to measure light intensity is called.....
   ii. .....is the process of breakdown of parent rock material.
   iii. ..... are organisms that feed on plants.
   iv. ..... is an example of a xerophytic plant.
   v. The levels of energy transfer in a food chain are called .....

2. Write short notes on **any three** of the following: (5x3=15)
   (a) Food web
   (b) Temperature as an ecological factor
   (c) Raunkiaer's Life forms
   (d) Endemism

3. (a) Illustrate the following with the help of diagrams ONLY: (4x2=8)
   i. Soil Profile
   ii. Single channel energy flow model

P.T.O.

(b) What are the different bio-geographical zones of India? Describe their salient features.

4. (a) Define ecological succession. Explain the process of ecological succession occurring in a water body with the help of suitable diagrams.

(b) What are biogeochemical cycles? Discuss phosphorous cycle with the help of a diagram.

SECTION – B

1. (a) Define **any five** of the following: (5x1=5)
   i. Taxon
   ii. Herbarium
   iii. Flora
   iv. Basionym
   v. OTU
   vi. *nom.cons.*

   (b) Identify the taxonomic rank of the following: (5x0.5=2.5)
   i. Brassicaceae
   ii. *Sorghum*
   iii. Asterales
   iv. Magnoliopsida
   v. Disciflorae

2. Write short notes on any **three** of the following: (3x5=15)
   (a) Principle of priority and its limitations
   (b) Type method
   (c) Englerian concept of a primitive flower
   (d) Rejection of scientific names
   (e) Importance of botanical garden in taxonomy

3. Differentiate between **any three** of the following: (3x5=15)
   (a) Phenogram and Cladogram
   (b) Indented key and Parallel key
   (c) Phenetic and Phylogenetic classification
   (d) Continuous and discontinuous variations
   (e) Taxonomic category and taxonomic group

4. (a) Give an outline of the system of classification proposed by Engler and Prantl for seed plants (upto the level of series). Enumerate its merits and demerits. (5 + 3 = 8)

(b) Discuss the role of palynology in solving taxonomic problems with suitable examples. (7)

Unique Paper Code : 42354401
Name of the Paper : Real Analysis
Name of the Course : B.Sc. (Prog) Physical Sciences/Mathematical Sciences
Semester : IV
Duration : 3 Hours

Maximum Marks: 75

(Write your Roll No. on the top immediately on receipt of this question paper.)
All questions are compulsory.
*Attempt any **two** parts from each question.*

1. (a) Define a countable set. Show that the set $\mathbb{Q}$ of rational numbers is countable.

(b) Define absolute value of a real number 'x'.
Find all $x \in \mathbf{R}$ that satisfy the following inequalities:
(i) $4 < |x+2| + |x-1| < 5$
(ii) $|2x-1| \leq x+1$

(c) (i) Define supremum of a non-empty bounded subset S of $\mathbf{R}$.
(ii) Show that a real number u is the supremum of a non-empty subset S of $\mathbf{R}$ if and only if it satisfies the following conditions:
(1) $s \leq u$ for all $s \in S$.
(2) For each positive real number ε, there exists $s_\varepsilon \in S$ such that $u - \varepsilon < s_\varepsilon$.

(6,6)

2. (a) State the Archimedean Property of real numbers. Show that if $x \in \mathbf{R}$, then there exists a unique $n \in \boldsymbol{Z}$ such that $n-1 \leq x < n$.

(b) Define the convergence of a sequence (x_n) of real numbers. Using the definition, evaluate the following limits:

(i) $\lim_{n\to\infty} \sqrt{n+1} - \sqrt{n}$
(ii) $\lim_{n\to\infty} \left(\frac{(-1)^n n}{n^2+1}\right)$

(c) Let (x_n) be a sequence of real numbers that converges to x and suppose that $x_n \geq 0$, $\forall\, n \in \boldsymbol{N}$. Show that the sequence $(\sqrt{x_n})$ converges to $\sqrt{x}$.

(6,6)

3. (a) Prove that every monotonically decreasing and bounded below sequence of real numbers converges.

(b) Show that the sequence (x_n) defined by
$x_1 = 1; x_{n+1} = \frac{1}{4}(2x_n + 3)$, $\forall n \geq 1$ is convergent. Also, find $\lim_{n\to\infty} x_n$.

(c) State Cauchy's Convergence Criterion for sequences of real numbers. Show directly from the definition that the following sequence is a Cauchy sequence:

$$\left(1+\frac{1}{2!}+\frac{1}{3!}+\cdots+\frac{1}{n!}\right).$$

(6.5, 6.5)

4. (a) State and prove Comparison test for positive term series. Hence, show that the following series converges:

$$1+\frac{1}{2^2}+\frac{1}{3^3}+\frac{1}{4^4}+\cdots$$

(b) Suppose that (x_n) is a sequence of non-negative real numbers. Prove that the series $\sum x_n$ converges if and only if the sequence $S = (s_k)$ of partial sums is bounded.

(c) (1) State (without proof) D'Alembert's ratio test for an infinite series.

(2) Test for convergence the series:

(i) $\frac{1}{3}+\frac{1.2}{3.5}+\frac{1.2.3}{3.5.7}+---.$

(ii) $\frac{1}{\log 2}+\frac{1}{(\log 3)^2}+\frac{1}{(\log 4)^3}+\cdots$

(6.5, 6.5)

5. (a) (i) Define an absolutely convergent series. Is every convergent series absolutely convergent? Justify your answer.

(ii) Test for convergence the series:

(1) $1-\frac{1}{2}+\frac{1}{2^2}-\frac{1}{2^3}+\frac{1}{2^4}---$

(2) $\sum_{n=1}^{\infty}(-1)^n.e^{-n}$

(b) Show that if $a > 0$, then the sequence $\left(\frac{nx}{1+n^2x^2}\right)$ converges uniformly on the interval $[a, \infty)$ but not uniformly on the interval $[0, \infty)$.

(c) State Weierstrass M-Test for uniform convergence of series. Hence, show that

$$\sum \frac{1}{x^2+n^2}, \quad \forall x \in \mathbf{R}$$

is uniformly convergent.

(6.5,6.5)

6. (a) Find the radius of convergence and exact interval of convergence of the power series

$$\sum \frac{n+1}{(n+2)(n+3)}x^n.$$

(b) Show that the function $f(x) = x^2$ defined on the interval $[0, b]$, where $b > 0$ is Riemann integrable.

(c) Show that every continuous function defined on $[a, b]$ is Riemann integrable.

(6,6)

[This question paper contains 8 printed pages.]

22 MAY 2023

Your Roll No.....

Sr. No. of Question Paper : 5714 **E**

Unique Paper Code : 42221201

Name of the Paper : Electricity, Magnetism and EMT

Name of the Course : **B.Sc. Prog. – CBCS Core**

Semester : II

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 **Five** questions in all.
3. Question No. **1** is compulsory.
4. Attempt **four** questions from the rest of the paper.
5. Use of non-programmable calculator is allowed.

P.T.O.

1. Attempt any **five** of the following : (5×3=15)

(a) Given a vector $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$. Show that $\oiint_S \vec{r}.d\vec{S} = 3V$, where V is volume enclosed by surface S.

(b) Prove that the electric field at any point can be expressed as the negative gradient of potential at that point.

(c) Two concentric spheres of diameters 10 cm and 12 cm where medium between the spheres is air and the outer sphere is earthed make a spherical capacitor. Find the charge on the inner sphere if the potential difference between the spheres is 10,000 volt.

(d) Differentiate between diamagnetic and paramagnetic material (mention any two points). Give one example of each.

(e) In a coil an emf of 6 V is induced when the current in the coil changes at the rate of 100 Amp per second. Find coefficient of self-inductance of the coil.

(f) What is Lenz's law? Show that it is in accordance with the law of conservation of energy.

(g) How does the electric field produced by the varying magnetic field differ from the electric field of stationary charges?

2. (a) Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at (2, –1, 2) in the direction $2\hat{i} - 3\hat{j} + 6\hat{k}$. (5)

(b) Prove that $\nabla^2 r^n = n(n+1)r^{n-2}$ where n is constant. (5)

(c) Given $\vec{A} = (3x^2 + 6y)\hat{i} - 14yz\hat{j} + 20xz^2\hat{k}$. Evaluate the line integral from (0, 0, 0) to (1, 1, 1) along the following paths c: $x = t$, $y = t^2$, $z = t^3$. (5)

3. (a) Using Gauss's theorem, find an expression for the electric field due to an infinite line charge of uniform charge density X at a perpendicular distance 'a' from it. (5)

(b) Derive expressions for the electric potential due to a uniformly charged spherical shell at points inside and outside the shell. Show that the electric potential due to the shell at any point inside is equal to the value of the potential on its surface. (7)

(c) Show that the potential function $V = a(x^2 + y^2 + z^2)^{1/2}$ does not satisfy Laplace's equation. (3)

4. (a) What do you understand by polarization of a dielectric? Define three electric vectors $\vec{D}$, $\vec{E}$ and $\vec{P}$. Establish the relation between them. (7)

(b) How does the capacitance of a parallel plate capacitor change when a dielectric slab of dielectric constant K is inserted between the plates and it completely fills the space between the plates? (4)

(c) A parallel plate capacitor with plate area 1 m^2 is completely filled with a dielectric material of dielectric constant 5. The capacitor is charged to a potential of 200 volt. If the distance between the plates is 0.01 cm, find the energy stored in the capacitor. (4)

5. (a) Starting from Biot Savart's law, derive an expression for the magnetic vector potential at a distance $\vec{r}$ from the current element. (5)

(b) Derive an expression for magnetic field of a small current loop. (5)

(c) Using Biot Savart's law calculate the magnetic field due to a finite current element. (5)

6. (a) Explain Faraday's law and Lenz's law of Electromagnetic induction. (4)

(b) Define coefficient of self-inductance. Derive an expression for self-inductance of a solenoid. (2+3=5)

(c) A solenoid of 80 cm length has 550 turns and 2 cm diameter. Calculate :

(i) the self-inductance of the solenoid.

(ii) the magnetic flux linked with coil when the current in the solenoid is 2 A.

(iii) the rate of change of current in the solenoid that will produce a self- induced emf of 0.3 volts. (6)

7. (a) Write Maxwell's equations for electromagnetic field in integral and differential form in free space. Obtain the wave equations for the electric and magnetic field vectors in vacuum. (7)

(b) An electromagnetic wave propagates along the x direction, the magnetic field oscillates at a frequency of 10^{10} Hz and has an amplitude of 10^{-5} T, acting along the y-direction. Write down the expression of the electric field and compute the wavelength of the wave. (4)

(c) Derive the equation of continuity using Maxwell's equation and give its significance. (4)

P.T.O.

Physical Constants :

$\varepsilon_0 = 8.854 \times 10^{-12}$ C/N-m^2:

$\mu_0 = 4\pi \times 10^{-7}$ Wb/A-m;

$c = 3 \times 10^8$ m/s.

$e = 1.6 \times 10^{-1}$ m/s

[This question paper contains 8 printed pages.]

Your Roll No. .....

Sr. No. of Question Paper : 5716

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.

P.T.O.

1. (i) Define the following terms **(any five)** : (5)

(a) Linkage

(b) Barr body

(c) Position effect

(d) Chiasmata

(e) Nonsense mutation

(f) Haploinsufificiency

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

(a) Heterogametic and homogametic

(b) Back mutation and suppressor mutation

(c) Incomplete dominance and co-dominance

(iii) Justify the following statements : (2)

(a) Recombination frequency never exceeds 50%.

(b) The reciprocal crosses between white-eyed and red-eyed Drosophila flies do not yield identical results.

(iv) One form of color blindness (c) in humans is caused by an X-linked recessive mutant gene. A woman with the normal vision (c^+) whose father was color blind marries a man with normal vision whose father was also color blind. What proportion of their offspring will be color blind. Write the genotype and phenotype of parents and offspring. (3)

P.T.O.

2. (a) What is extrachromosomal inheritance? Explain with suitable examples. (8)

(b) How does sex determination in the XX-XY system differ from sex determination in ZZ-ZW system? (4)

3. (a) Briefly discuss the various types of chromosome structural mutations. (8)

(b) A panel of cell line was created from human-mouse somatic-cell fusions. Each line was examined for the presence of human chromosomes and for the production of an enzyme. The following results were obtained :

Cell Line	Enzyme			Human Chromosomes										
	X	Y	Z	1	2	3	4	5	6	7	8	9	10	17	22
A	—	—	—	+	—	—	—	—	—	—	—	—	—	+	—
B	+	+	—	+	+	—	—	—	—	—	+	—	—	+	+
C	—	+	+	+	—	—	—	+	—	—	—	—	—	—	+
D	—	—	—	—	—	—	+	—	—	—	—	—	—	—	—
E	+	—	—	+	—	—	—	—	—	—	+	—	+	+	—

On the basis of these results, which chromosome has the gene that encodes the enzyme X, Y and Z? Justify your answer. (4)

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

(a) Polyploidy

(b) Multiple alleles

(c) Polygenic inheritance

(d) Lyon hypothesis

P.T.O.

SECTION B – EVOLUTIONARY BIOLOGY

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

1. (i) Define the following **(any five)** : (5)

(a) Vestigial organs

(b) Adaptive radiation

(c) Paleontology

(d) Genetic drift

(e) Artificial selection

(f) Cambrian explosion

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

(a) Convergent and Divergent evolution

(b) Sympatric and allopatric speciation

(c) Darwinism and Neo-Darwinism

(d) Coacervates and microspheres

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

(a) Alfred Russel Wallace

(b) J. Huxley

(c) Georges Cuvier

2. (a) What is macroevolution? Discuss the macroevolutionary principles with the help of evolution of Darwin's Finches. (8)

(b) What is the significance of fossil records in evolution? (4)

3. What is mass extinction? Briefly describe the five major mass extinctions and the significance of extinction in evolution. (12)

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

(a) Natural Selection

(b) Biological Species Concept

(c) Post-zygotic isolating mechanisms

(d) Hardy-Weinberg Law

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5744

E

Unique Paper Code : 42167901

Name of the Paper : Economic Botany and Biotechnology

Name of the Course : **Life Sciences**

Semester : VI

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 **Five** questions in all including Question No. **1** which is compulsory.
3. All parts of a question must be answered together.
4. **All** questions carry equal marks.

P.T.O.

1. (a) Fill in the blank **(Any 5)** : (5×1=5)

(i) Gynogenesis was first reported by _____.

(ii) _____ genetic transformation is a most common method for development of Bt cotton.

(iii) Artificial seeds are generally encapsulated by _____.

(iv) Clove oil is extracted from _____.

(v) Anther culture produces _____ plants.

(vi) SDS PAGE separates proteins on the basis of _____.

(b) Expand **(Any 5)** : (5×1=5)

(i) NBPGR

(ii) pBR 322

(iii) GUS

(iv) BAC

(v) DBT

(vi) FAO

(c) Match the following **(Any 5)** : (5×1=5)

(i) Black pepper	(a) A. M. Chakraborty
(ii) Endosperm Culture	(b) Pipeline
(iii) Theol	(c) E.C. Cocking
(iv) Ginning	(d) Cotton
(v) Plant protoplast	(e) triploids
(vi) Superbug	(f) Tea

2. Write short notes **(Any three)** : (5×3=15)

(i) Golden rice

(ii) Cryopreservation

(iii) Flavr Savr tomato

(iv) Processing of cotton

(v) Hexaploid wheat

3. Differentiate between **(any three)** : (5×3=15)

(i) Southern Blotting and Northern Blotting

(ii) Black pepper and White pepper

(iii) Cloning vector and expression vector

(iv) Black tea and Green Tea

(v) Micropropagation and vegetative propagation

4. Draw well-labelled diagram **(any three)** : (5×3=15)

   (i) L.S, Clove Bud

   (ii) L.S. wheat grain

   (iii) L.S. Cotton seed

   (iv) T.S. Black Peppercorn

   (v) Amplification of DNA in PCR

5. (a) Explain the centre of origin of cultivated plants concept by N.I. Vavilov? (5)

   (b) What do you mean by protoplast isolation? Briefly explain the factors influencing protoplast isolation, culture and fusion along with its applications. (5)

   (c) Discuss the morphology of groundnut plant with special emphasis on its fruit. Write its economic importance. (5)

6. Explain briefly **(any three)** : (5×3=15)

   (a) Agrobacterium-mediated transformation

   (b) Ti plasmid

   (c) Secondary metabolite production

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5746

E

Unique Paper Code : 42167904

Name of the Paper : Analytical Techniques in Plant Sciences

Name of the Course : **B.Sc. Life Sciences**

Semester : VI

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 **five** questions in all.
3. **All** questions carry equal marks.
4. Question No. **1** is compulsory.
5. **All** parts of a question must be answered together.

1. (a) Expand the following **(any five)** : (5×1=5)

   (i) FISH

   (ii) FACS

   (iii) TLC

   (iv) RCF

   (v) MALDI

(vi) GFP

(vii) RFLP

(b) Define the following (**any five**) : (5×1=5)

(i) Positive Staining

(ii) T-Banding

(iii) Cryofixation

(iv) Marker enzymes

(v) Chromosome banding

(vi) Fluorochrome

(c) Fill in the blanks (**any five**) : (5×1=5)

(i) The sedimentation coefficient is expressed as _____ units.

(ii) The instrument used for obtaining sections of uniform thickness for observing under the microscope is called the _____

(iii) A thermostable enzyme used in PCR is _____

(iv) The electrophoretic mobility for separation of nucleic acid depends upon _____ differences of the molecule.

(v) _____ is a marker enzyme for peroxisomes.

(vi) _____ lensesare used in electron microscopes.

(vii) _____ is a fluorescent dye used to stain DNA.

2. Differentiate between any **five** : (5×3=15)

(i) Positive Staining and negative staining

(ii) Paper Chromatography and Thin layer chromatography

(iii) SEM and TEM

(iv) Differential centrifugation and Density gradient centrifugation

(v) Freeze fracturing and Freeze etching

(vi) AGE and PAGE

3. Write short notes on any **three** : (3×5=15)

(i) Affinity Chromatography

(ii) X -ray crystallography

(iii) Autoradiography

(iv) Confocal Microscopy

4. (a) Explain the procedure and applications of the Polymerase Chain Reaction. (5)

(b) Briefly explain the sample preparation for electron microscopy. (5)

P.T.O.

(c) Explain the pulse-chase experiment in detail with an example. (5)

5. Describe the following techniques and their applications (**any three**) (3×5=15)

(i) Shadow Casting

(ii) Fluorescence microscopy

(iii) Molecular sieve chromatography

(iv) Mass spectrometry

6. (a) Define resolution. Describe different factors that influence the resolution and resolving power of a microscope. (7)

(b) What are radioisotopes? Give an account of different types of radiations emitted by radioisotopes. Discuss the role of Radioisotopes in biological research (8)

7. (a) Briefly discuss the technique of flow cytometry and its applications. (6)

(b) Explain the principle, working and applications of Western Blotting. How is it different from Southern blotting? (9)

[This question paper contains 8 printed pages.]

Your Roll No......

Sr. No. of Question Paper : 5774

Unique Paper Code : 42164401

Name of the Paper : Plant Physiology and Metabolism

Name of the Course : **B.Sc. (Programme) 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. Only **Five** questions are to be attempted in all.
3. Question **1** is compulsory.
4. **All** questions carry equal marks.
5. Attempt all parts of the question together.
6. Illustrate your answers wherever possible.

P.T.O.

1. (a) Give **one** significant contribution of the following **(any five)** : (1×5=5)

(i) R. Hill

(ii) T.W. Engelmann

(iii) F.W. Went

(iv) R Mitchell

(v) D. Neljubowa

(vi) M. Chailakhyan

(b) Expand the abbreviations **(any Five)** : (5)

(i) CoA

(ii) UDP

(iii) NR

(iv) Pfr

(v) NADP

(vi) FMN

(c) Name the following **(any five)** : (5)

(i) A Plant species carrying Selenium.

(ii) A natural Chelating agent.

(iii) A nutrient solution for hydroponics.

(iv) An element stimulating pollen tube germination and elongation.

(v) A type of P-protein that occur only in certain legumes.

(vi) Ordinary companion cells with the development of finger like wall ingrowths.

2. (a) Give the schematic representation of Electron Transport Chain in mitochondrion. Tabulate the total ATP produced at various stages in aerobic respiration of a glucose molecule. (5)

(b) Explain the following **(any five)** : (1×5=5)

(i) Feedback inhibition

(ii) Florigen

(iii) Prosthetic group

(iv) Pfr

(v) Vernalization

(vi) Cofactor

(vii) Denitrification

(c) How the K^+ ion channels enhance the diffusion of K^+ across membrane? Discuss. (5)

3. (a) Write a detailed account of photosynthetic dark reaction. Illustrate your answer. (5)

OR

(a) With the help of vectorial arrangement of PSI & PS II, give the account of light reactions.

(b) What are enzymes? How are they classified under broad categories? (5)

(c) Discuss girdling experiment along with the structure of phloem and composition of the phloem sap. (5)

4. (a) Write an explanatory note on **(any four)** : (2.5×4=10)

(i) Discovery of Cytokinins

(ii) Ammonification

(iii) Interplay of hormones during abscission

(iv) *Rhizobium*

(v) Fruit Ripening

(vi) Dinitrogenase

(vii) Nod genes

(b) The value for water potential in the stem tissue was found to be –3.5 bars. If you take the root tissue and place it in a 0.1M solution of sucrose at 20°C in an open beaker, what is the water potential of the solution and in which direction will the net flow of water be? What will happen if we replace 0.1 M sucrose with 0.1 M NaCl. (5)

P.T.O.

OR

(b) Discuss three major factors that contribute to cell water potential. Give significance/uses of concept of water potential.

5. (a) Differentiate between PCO and PCR. (5)

OR

(a) Discuss *Krapz* anatomy in relation to functional features of C4 syndrome.

(b) Describe the process of rhizobial infection and nodule development in a legume root. (5)

(c) Differentiate between **(any two)** : (2.5×2=5)

(i) Phloem loading and Phloem unloading

(ii) Hydroponics and Aeroponics

(iii) Passive transport and Active transport.

6. (a) Discuss the sequential events of Krebs cycle. Which reaction is commonly known a link reaction? (5)

OR

(a) Define RQ. Give its significance in plant metabolism.

(b) Describe briefly about phytochrome with reference to its structure and role in plants. (5)

(c) The driving force of transpiration is the difference in vapor pressure concentration, justify the statement. What pressure difference is needed to lift water 100 meters to a treetop? (5)

7. (a) With the help of a neat illustration, discuss the role of GAs in food reserve mobilization in barley seed. (5)

(b) Explain briefly **(any five)** : (1×5=5)

(i) K_m

(ii) photoperiod

P.T.O.

(iii) chromophore

(iv) Active site

(v) Epinasty

(vi) Activation energy

(c) Describe any two mechanisms that can explain the phloem loading. (5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5778

Unique Paper Code : 42224412

Name of the Paper : Waves and Optics

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

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. **Question no. 1** is compulsory.
3. Attempt **any five** questions in all.
4. **All** questions carry equal marks.

1. (a) State the principle of superposition in the context of two collinear harmonic oscillations of same frequency.

(b) What are beats? Writean expression for the frequency of beats.

(c) Compare the intensity pattern obtained by Young's double slit interference experiment and Fraunhofer diffraction due to a double slit.

(d) Write two differences between travelling and stationary waves.

(e) Distinguish between Fizeau and Haidinger Fringes? Give examples.

(f) Distinguish between Fraunhofer and Fresnel's class of diffraction.

(g) Calculate the change in intensity level when the intensity of sound increases 100 times its original intensity.

2. (a) What do you understand by Lissajous figures? (3)

(b) Find the resultant of two perpendicular simple harmonic motions whose amplitude are in the ratio 1:2 and the phase difference is 90°. (12)

3 (a) What are normal modes of vibration in a stretched string?Discuss the possible modes of vibration of a stretched string of finite length fixed at both ends. (8)

(b) What do you mean by wave velocity and group velocity? Derive the relation between them in a dispersive medium. (7)

4. (a) Explain how sound waves are produced. What do you understand by intensity and loudness of sound? (7)

(b) How does a noise is different from musical notes? Discuss in detail how musical scales are made? (8)

5. (a) Explain the phenomenon of interference of light due to thin films and find the condition for maxima and minima. (10)

(b) An oil film (μ=1.47) of thickness t=0.12 μm rests on a pool of water. If light strikes the film at an angle of 60°, what is the wavelength reflected in the first order? (5)

P.T.O.

6. (a) Describe the construction and working of Michelson's interferometer. Explain how it is used to determine wavelength of monochromatic light. (10)

(b) When the movable mirror of Michelson interferometer is moved through 0.06854 mm, a shiftof 220 fringes is observed. Find the wavelength of light used. (5)

7. (a) Explain with theory, Fresnel type of diffraction due to straight edge. (7)

(b) Explain the theory of plane transmission grating. How it can be used to find the wavelength of light? (8)

8. (a) What do you mean by plane polarised light? What are the various ways to produce it? (7)

(b) Describe how one can produce and detect circularly-polarised and elliptically-polarised light with the help of Nicol prism and quarter-wave plate. (8)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5780 **E**

Unique Paper Code : 42231202

Name of the Paper : Comparative Anatomy and Developmental Biology of Vertebrates

Name of the Course : **BSc. (P) Life Sciences, Theory Exam, May-June 2023**

Semester : II, CBCS, OC

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. **Question No. 1** is compulsory. There are two sections, **Section A and B.** Attempt **two** questions from each section. Attempt **five** questions in all.

1. (a) Define the following terms (6)

(i) Monophyodont Dentition

(ii) True stomach

(iii) Antlers

(iv) Fertilization

(v) Gastrulation

(vi) Phonoreceptor

(b) Differentiate between the following terms: - (10)

(i) Monocondylic and Dicondylicskull

(ii) External and Internal fertilization

(iii) Epidermal and Dermal derivatives

(iv) Blastula and Gastrula

(v) Bolus and Chyme

(c) Fill in the blanks: (5)

(i) The tongue of mammals is attached to buccal floor by a ligament called _____.

(ii) Poison glands of snake are modified _____.

(iii) Slow block polyspermy is achieved by _____ reaction.

(iv) The process of differentiation of spermatid into spermatozoa is called _____.

(v) The process of attachment of embryo to the

inside of uterine wall in humans is known as _____.

(d) Match the following (6)

A	B
(i) Blastocyst	(a) Brain
(ii) Corpora quadrigemina	(b) Extraembryonic membrane
(iii) Placenta	(c) Inner cell mass
(iv) Nephrostome	(d) Tongue
(v) Chemoreceptors	(e) Nutrition
(vi) Amnion	(f) Kidney

Section A

2. (a) Trace the evolution of lungs in vertebrates (8)

(b) Write a short note on L.S. syrinx in birds (4)

3. Give a detailed account of the evolution of heart in vertebrates, with the help of suitable diagrams. (12)

4. Write short notes on any three of the following: - (4, 4, 4)

(a) Specializations of the alimentary canal

(b) Dentition in mammals

(c) Accessory respiratory organs in fishes

(d) Mammalian brain

Section B

5. (a) Describe the process of gastrulation in frog. (8)

(b) Mention briefly the fate of the three germ layers. (4)

6. (a) Discuss in detail the mechanism of Oogenesis in mammals (6)

(b) Explain various mechanisms involved by oocyte to prevent polyspermy? (6)

7. Write short notes on any threeof the following: -

(a) Implantation of human embryo

(b) Types of Eggs

(c) Neurulation

(d) Embryonic Induction (4, 4, 4)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5875 **E**

Unique Paper Code : 42237904

Name of the Paper : Immunology

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

Semester : VI

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 **five** questions in all. Question **1** is compulsory.
3. Draw well labelled diagrams wherever required.

1. (a) Define : (5)

(i) Cross-reactivity

(ii) Haplotype

(iii) Immunotolerance

(iv) Epitope

(v) Hapten

(b) Differentiate between the following : (8)

(i) Active Immunization & Passive Immunization

(ii) Primary & Secondary Immune response

(iii) Primary Lymphoid Organs & Secondary Lymphoid Organs

(iv) Innate Immunity & Acquired Immunity

(c) Expand the following : (3)

(i) PALS (ii) ADCC

(iii) GALT (iv) TLR

(v) TCR (vi) IFNγ

(d) Write the contribution of the following scientists : (4)

(i) Cesar Milstein and Georges E. Kohler

(ii) Emil Von Behring

(iii) Lady Mary Wortley Montagu

(iv) Rodney R. Porter

(e) Match the following : (3)

(i) Anaphylatoxins	(a) Tc cells
(ii) Neurophils	(b) C3a
(iii) MHC I	(c) Lungs
(iv) CD 4	(d) Antibodies
(v) Alveolar macrophages	(e) Granulocytes
(vi) Plasma cells	(f) TH cells

(f) Give reasons : (4)

(i) Self antigens do not produce immune response in normal persons.

(ii) Children are immunized with a single dose of BCG.

(iii) Rh incompatibility can be fatal in second pregnancy.

(iv) Certain sites of human body are called immune privilege sites.

2. (a) Explain the various experiments conducted to deduce the structure of immunoglobulin.

(b) Describe the structure and functions Class I and Class II MHC molecules. (8,4)

P.T.O.

3. (a) Give an account of the cells of innate and adaptive immunity.

   (b) Differentiate between B cell and T cell epitopes. (8,4)

4. (a) Discuss the production of monoclonal antibody by hybridoma technology.

   (b) Describe the initiation and activation of the classical complement pathway. (6,6)

5. (a) Explain the properties of cytokines.

   (b) Give an account of different types of vaccines. (8,4)

6. (a) Explain the different types of hypersensitivities on the basis of Gell and Coomb's classification.

   (b) Discuss various antibody-mediated effector functions. (8,4)

7. Write short notes on any **three** : (4,4,4)

   (a) Clonal Selection Theory

   (b) Properties of antigen

   (c) Thymus

   (d) ELISA