[This question paper contains 6 printed pages.]

(13)

Your Roll No. 2019

Sr. No. of Question Paper : 2341 **IC**

Unique Paper Code : 42171205

Name of the Paper : Chemical Energetics, Equilibrium & Functional Organic Chemistry– I

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

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. Use of Scientific calculator and log table is allowed.
3. Use separate sheets for **Section A** and **Section B**.

SECTION A
(PHYSICAL CHEMISTRY)

Attempt any **three** questions in all and Question No. **1** is compulsory.

1. Attempt any **five** questions :

   (a) What do you understand by buffer? Give an example of basic buffer.

P.T.O.

(b) What are extensive and intensive variables? Classify the following as extensive and intensive- molar entropy, enthalpy, temperature, heat capacity.

(c) State Le-Chatelier's principle and explain the effect of change of temperature on equilibrium.

(d) What is pH? Calculate the pH of 0.001 M NaOH.

(e) Differentiate between differential enthalpy of solution and integral enthalpy of solution.

(f) Why salts of strong acid and strong base do not get hydrolysed? (2.5×5)

2. (a) Define enthalpy of neutralization. The enthalpy of neutralization of HCl with NaOH is 57.3 $kJmol^{-1}$ and NH_4OH is -51.3 $kJmol^{-1}$. Calculate the enthalpy of ionization of NH_4OH.

(b) Explain the term entropy and give its physical significance. The entropy of the universe is increasing. Explain.

(c) What is the physical significance of ΔG? Show that $\Delta G_{sys} = -T\Delta S_{sys}$. (4,4,4½)

3. (a) What are the characteristics of chemical equilibrium? Find the relationship between Kp and Kc.

(b) Explain the following :

(i) A Solution of Na_2CO_3 is alkaline.

(ii) A solution of NaCl is neutral.

(c) Define solubility product. At 25°C, a saturated solution of $BaSO_4$ is 3.9×10^{-5} M. What is its solubility in 0.1 M Na_2SO_4 solution? (4,4,4½)

4. (a) Calculate the enthalpy change of the reaction

$$3C_2H_2\ (g) \rightarrow C_6H_6\ (g)$$

Given that Enthalpy of combustion of C_2H_2 (g) and C_6H_6 (g) are -1.30 $kJmol^{-1}$, -3.302 $kJmol^{-1}$ respectively.

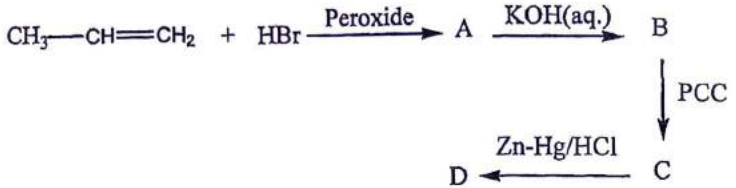
(b) Calculate the hydrolysis constant and degree of hydrolysis of 10^{-2} M solution of NH_4Cl. Given that K_b of NH_4OH is 1.8×10^{-5}M.

(c) What is C_v and C_p. Show that $C_p - C_v = R$. (4,4,4½)

SECTION B
(ORGANIC CHEMISTRY)

Attempt any **three** questions in all.

5. (a) Complete the following reaction and draw the structure of (A), (B), (C) and (D).



(b) Discuss how benzene is converted into chlorobenzene. Explain its mechanism.

(c) What do you understand by S_N1 and S_N2 reactions? Discuss the stereochemistry of S_N1 reaction. (4,4,4½)

6. (a) Give reason for the following :

(i) p-Nitrochlorobenzene undergoes nucleophilic substitution reaction faster than chlorobenzene.

(ii) Phenol is more acidic than alcohols.

(b) Why do aldehydes and ketones undergo nucleophilic addition reaction? Give chemical reaction for the formation of oxime.

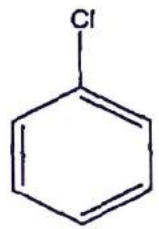
(c) How will you convert?

(i) Acetaldehyde to isopropyl alcohol

(ii) Acetyl chloride to acetaldehyde

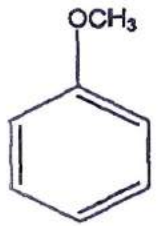
(2×2,4½,2×2)

7. (a) Complete the following reaction

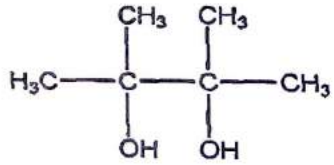
(i) 

+ KNH_2/NH_3 ⟶ ?

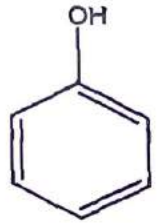
(ii) 2 HCHO + NaOH ⟶ ?

(iii) 

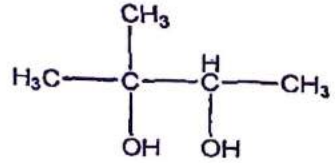
+ HI ⟶ ?

(iv) 

H^+ ⟶ ?

(v) 

+ Br_2 (aq.) ⟶ ?

(vi) 

HIO_4 ⟶ ?

(b) What is Lucas reagent? Describe Lucas test for distinguishing between primary, secondary and tertiary alcohol.

(c) Write the chemical reaction of acetone with phenyl hydrazine. (6,4,2½)

8. (a) Write short notes on any **two** of the following :

(i) Aldol condensation

(ii) Wittig reaction

(iii) Reimer-Teimann reaction

(b) What is oppenauer oxidation? Give its mechanism. (4,4,4½)

[This question paper contains 10 printed pages.]

(14)

Your Roll No....2019

Sr. No. of Question Paper : 2291 **IC**

Unique Paper Code : 42341202

Name of the Paper : Database Management Systems

Name of the Course : **B.Sc. (Prog.) / Math. 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. Question **1** is compulsory.
3. Answer any five questions out of remaining questions **(Q2-Q8)**.
4. Answer **all** parts of a question together.

1. (a) What is data redundancy? What are the disadvantages of having redundancy within a database? (2)

(b) What is meant by degree of a relationship type? (2)

P.T.O.

(c) From the tables **R** and **S**, find the following :

(i) R U S (1)

(ii) S – R (1)

(iii) Cartesian Product of R and S (2)

R

Sno	Dept
S1	Phy
S2	Psy
S3	Chem
S4	Jour

S

Sno	Dept
S10	Maths1
S3	Chem
S15	Eng
S16	Maths2

(d) Given the following table and its associated functional dependencies. (3)

Emp_proj

Emp_id	Project_id	Hours	Emp_name	Proj_name

Emp_id →Emp_name
Proj_id → Project_id
Emp_id,Proj_id →Hours

What is the highest normal form that the relation **Emp_proj** satisfies? Justify your answer.

(e) Give an example for each of the following : (2)

(i) Total participation

(ii) Recursive relationship

(f) Illustrate with the help of an example an anomaly that might arise if referential integrity constraint is not satisfied in a relational schema? (2)

(g) Consider the following table TABLE 1: (2)

TABLE 1

X	Y	Z
2	3	1
3	4	2
4	5	3
5	6	4
6	7	1
2	3	1

Which of the following functional dependency constraints do not hold in the table TABLE1?

(i) $YZ \rightarrow X$

(ii) $X \rightarrow Z$

(iii) $X \rightarrow Y$

(iv) $Z \rightarrow X$

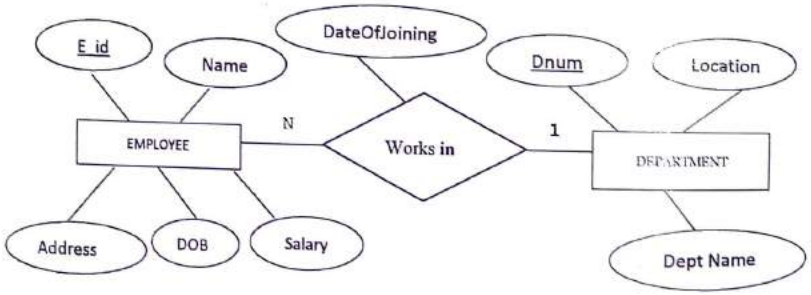
(h) What is Cardinality ratio? For the binary relationships below suggest cardinality ratios based on the meaning of the Entity types. State any assumptions you make. (3)

ENTITY 1	Cardinality Ratio	ENTITY 2
STUDENT	_____	TEACHER
COUNTRY	_____	CURRENT_PRESIDENT
ITEM	_____	ORDER

(in an order)

(i) What enhancements distinguish the EER model from the ER model? (2)

(j) Identify the tables needed to store the following model. You should not introduce tables unnecessarily. (3)



2. (a) What do you mean by the following terms? (4)

(i) Database catalog

(ii) Meta data

(b) What are the responsibilities of a database administrator? (2)

(c) Describe the 3-schema architecture. Why do we need mappings between schema levels? (4)

3. A University registrar's office maintains a database about the students having the following entities : (10)

- o courses, including number, title, credits, syllabus and prerequisites;
- o course offerings, including course number, year, semester, section number, instructor(s), timings and classroom;
- o students, including student-id, name and program;
- o instructors, including identification number, name, department, and title.

Further, for each student's enrollment in courses and grades awarded in each course in which the student is enrolled must be appropriately modeled.

(i) Identify the entities of interest.

(ii) Identify essential attributes associated with each entity with primary attributes marked.

(iii) Construct an E-R diagram for the registrar's office. State all assumptions that you make about the mapping constraints.

4. (a) Consider the following relational schema : (6)

```
Employee (eno,ename,dnum,dob,salary,street,city)
Works for (eno, proj no, hrs)
Department (dname, dno, mgr_no)
```

Give the following queries in relational algebra :

(i) Retrieve the name and address of all employees who work for **Research** department

(ii) Find the employee names who are either working in department no 4 and earn over 25,000 or are in department no 5 and earn over 30,000.

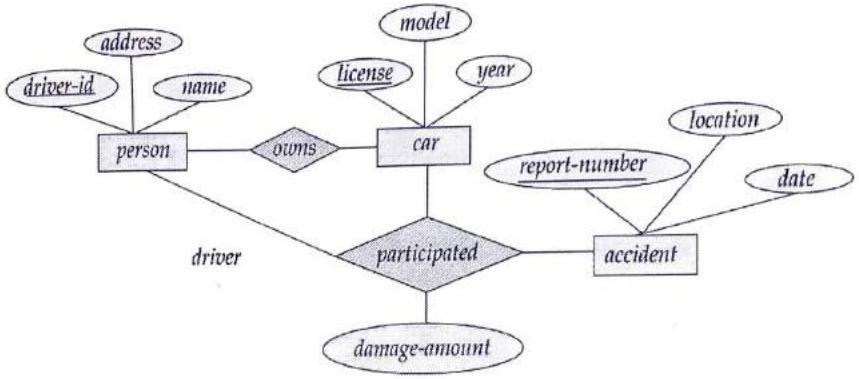
(iii) Find the names and salary of all managers.

(b) Differentiate between the following : (4)

(i) single valued attributes and multivalued attributes

(ii) intension and extension

5. (a) Given below is the ER diagram which models the **Car Insurance System**. Map the diagram into relational schema. Specify the primary key and foreign key. (6)



ER Diagram for the **Car Insurance System**

(b) Consider a relation **R(A,B,C,D)** with the following functional dependencies. (4)

$$AB \rightarrow C$$

$$CD \rightarrow E$$

$$DE \rightarrow B$$

Find out the candidate key for the above dependencies.

6. (a) Consider the following table : (5)

EMP_DEPT(EId, Ename, bdate, address, dnumber, dname, mgrssn)

EId	Ename	Bdate	Address	dnumber	dname	Mgrssn
E101	Ajay	10/02/1980	H-123,Janakpuri	D1	Sales	E106
E104	Swati	05/07/1974	A-5, Rani Bagh	D2	HR	E112
E105	Riya	12/10/1982	F-19,kirti Nagar	D5	IT	E105
E106	Deepak	07/07/1970	A-66, Pitampura	D1	Sales	E106
E112	Amit	15/03/1972	GH-34, PVihar	D3	Admin	E112
E110	Deepti	06/05/1985	A1-23, Janakpuri	D5	IT	E105

If the following operations are performed, check if one or more of the following constraints are violated :

domain constraint, key constraint, entity integrity constraint

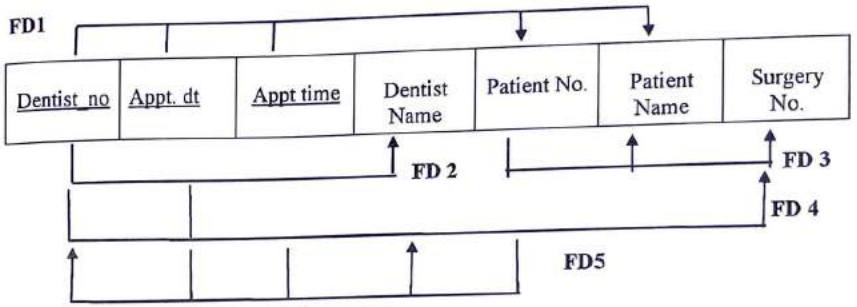
(i) Insert a tuple ('E106', 'Supriya', '01/01/1992', 'X-22, Vasant Kunj', D5, 'IT', 'E105') into the **EMP_DEPT** table.

(ii) Insert a tuple ('E122', 'Rama', '11/07/1989', 'MM-122, Kalu Saray', D1, 'Sales', 'E106') into the **EMP_DEPT** table.

(iii) Insert a tuple (NULL, 'Zaheer', '11/02/1995', 'AA-98, 'Rajpur Road'sant Kunj', D5, 'IT', 'E105') into the **EMP_DEPT** table

(b) Using diagrams give an examples illustrating the following concepts.
specialization hierarchy and specialization lattice. (5)

7. (a) (8)



Consider the above relation having the depicted functional dependencies.

Apply normalization successively till 3NF. State the reasons behind each decomposition.

(b) Prove that a relation schema R(A, B) with two attributes is always in BCNF. (2)

8. (a) Consider the following schema about a library system having several branches.

BOOK (BookId , Title , PublisherName)
BOOK_COPIES (BookId, BranchId , NoOfCopies)
LIBRARY_BRANCH (BranchId, BranchName , Address)
BOOK_AUTHORS (BookId , AuthorName)
BOOK_LOANS(BookId,BranchId,CardNo,DateIssue,DueDate)
BORROWER (CardNo, Name, phone , Address)

Write the following queries in SQL : (2×5=10)

(i) List the title of books issued to **'Ramesh'**.

(ii) Change the Publisher Name of BookId B10 to **'BPB'**.

(iii) Find the maximum number of copies that a book has.

(iv) How many copies of the book titled **'Fundamentals of Accounting'** are owned by each library branch?

(v) Give the list of book titles, branch-wise.

This question paper contains **4** printed pages]

2019

Roll No. | | | | | | | | | | | |

15

S. No. of Question Paper : **2293**

Unique Paper Code : **42351201**

Name of the Paper : **Calculus and Geometry**

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

Semester : **II**

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.

Marks of each part are indicated.

1. (*a*) Use (ε, δ) definition to prove that $\lim_{x \to -1} (7x + 5) = -2$.
Find a $\delta > 0$ if $\varepsilon = 0.01$. 6

(*b*) Let the function be defined as :

$$f(x) = \begin{cases} 2x + 3, & x \leq 4 \\ 7 + \dfrac{16}{x}, & x > 4 \end{cases}$$

Find the value of x (if any) at which f is not continuous. 6

P.T.O.

(*c*) Define uniform continuity of a function on the interval I.

Show that the function $f(x) = \frac{1}{x}$ is not uniformly continuous on]0, 1]. 6

2. (*a*) Discuss the derivability of the function :

$$f(x) = \begin{cases} 2x - 3, & 0 \le x < 2 \\ x^2 - 3, & 2 \le x \le 4 \end{cases}$$

at $x = 2$. 6

(*b*) (*i*) State Lagrange's Mean Value Theorem and give its geometrical interpretation.

(*ii*) If f is a function satisfying all the hypothesis of Lagrange's Mean Value Theorem in $[a, b]$ and $f'(x) > 0 \ \forall x \in (a, b)$, then prove that f is increasing on $[a, b]$. 4,2

(*c*) Find the asymptotes of the curve :

$$x^3 + 2x^2y + xy^2 - x^2 - xy + 2 = 0.$$ 6

3. (*a*) Determine the intervals of concavity and points of inflexion of the curve

$$y = 2x^4 - 3x^2 + 2x + 1.$$ 6

(*b*) Prove that the curve $y^2 = (x - a)^2 (x - b)$ has at $x = a$, a node if $a > b$, a cusp if $a = b$ and a conjugate point if $a < b$. 6

(*c*) Trace the curve $y^2(a^2 - x^2) = x^4$. 6

4. (*a*) Trace the curve $x = a(\theta - \sin\theta)$, $y = a(1 - \cos\theta)$, $0 \le \theta \le 2\pi$. 6.5

(*b*) Show that :

$$\int \sin^m x \cos^n x \, dx = \frac{-\cos^{n+1} x \sin^{m-1} x}{m+n} + \frac{m-1}{m+n} \int \sin^{m-2} x \cos^n x \, dx$$

m, n being positive integers. 6.5

(*c*) Find the length of the loop of the Cardioid :

$$r = a(1 + \cos\theta).$$

Or

Evaluate the definite integral :

$$\int_0^{2a} x^2 \sqrt{2ax - x^2} \, dx.$$ 6.5

5. (*a*) Find the volume of the solid that is obtained when the region under the curve $y = \sqrt{x}$ over the interval [1, 4] is revolved about the x-axis. 6

(*b*) Describe the graph of the equation :

$$x^2 - y^2 - 4x + 8y - 21 = 0.$$ 6

(*c*) (*i*) Find an equation for the ellipse with foci $(0, \pm 2)$ and major axis with end-points $(0, \pm 4)$.

(*ii*) State reflection property of a parabola. 4,2

6. (*a*) Rotate the coordinate axes to remove the xy-term from the equation $x^2 - xy + y^2 - 2 = 0$. Then identify the type of conic and sketch its graph. 7

(*b*) (*i*) Find the divergence and the curl of the vector field :

$$\vec{F}(x, y, z) = x^2 y\,\hat{i} + 2y^3 z\,\hat{j} + 3z\,\hat{k}.$$

(*ii*) Sketch the ellipsoid :

$$\frac{x^2}{4} + \frac{y^2}{16} + \frac{z^2}{9} = 1. \qquad 4,3$$

(*c*) (*i*) Calculate $\frac{d}{dt}\left(\vec{F} \times \vec{G}\right)$ for vector functions :

$$\vec{F}(t) = 2t\,\hat{i} + 3t^2\,\hat{j} + t^3\,\hat{k} \text{ and } \vec{G}(t) = t^4\,\hat{k}.$$

(*ii*) Verify $\nabla \| \vec{r} \| = \frac{\vec{r}}{\| \vec{r} \|}$ for the radius vector

$$\vec{r} = x\,\hat{i} + y\,\hat{j} + z\,\hat{k}. \qquad 4,3$$

[This question paper contains 6 printed pages.]

16

Your Roll No. 2214

Sr. No. of Question Paper : 2333 IC

Unique Paper Code : 42221201

Name of the Paper : Electricity, Magnetism and EMT

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

1. Attempt any **five** of the following :

   (a) If $\varphi(x,y,z) = 3x^2y - y^3x^2 + z^2$, calculate gradient of φ at the point $(1, -2, -1)$.

   (b) Can the following be a possible electrostatic field?

$$\vec{E} = xy\hat{i} + 2yz\hat{j} + 3xz\hat{k}$$

P.T.O.

(c) State Poynting theorem and explain what do you understand by the Poynting vector.

(d) If $\vec{A}$ and $\vec{B}$ are irrotational, prove that $\vec{A}\times\vec{B}$ is solenoidal.

(e) Prove that $\vec{\nabla}.\vec{B}=0$ and explain its physical significance.

(f) Distinguish between dia-, para- and ferro-magnetic materials.

(g) Discuss the difference between induced electric field and electric field due to static charges.

(5×3=15)

2. (a) Find the work done in moving a particle in the force field

$$\vec{F}=\left(2x+y^2\right)\hat{i}+\left(3y-4x\right)\hat{j}$$

along the straight lines from (0,0) to (2,0), then to (2,1), then to (0,0).

(b) Show that the following function is a sink field

$$\vec{V}=\frac{-x\hat{i}-y\hat{j}}{\sqrt{x^2+y^2}}$$

(c) Prove that $\vec{\nabla}.\left(\vec{\nabla}\times\vec{A}\right)=0$. (6,6,3)

3. (a) Use Gauss's law to find the electric field inside, outside and on the surface of a uniformly charged solid sphere having charge density ρ.

(b) Derive an expression for an electrostatic potential due to a uniformly charged spherical shell at a point inside and outside the shell.

(c) The electric potential at any point (x,y,z) is given by $V=x(3y^2-x^2+z)$. Find the electric field at that point. (6,6,3)

4. (a) Derive $Q_p=Q\left(1-\frac{1}{k}\right)$ for a capacitor with dielectric between the parallel plates, where Q_p is the induced charge and k is dielectric constant. Calculate the capacitance of a parallel plate capacitor of plate area 5 cm^2 and separated by dielectric of dielectric constant 4 and thickness 1 cm.

(b) What is meant by polarization of a dielectric? Obtain generalized form of Gauss's law for a polarized dielectric.

(c) The magnetic field $\vec{B}$ due to a current carrying circular loop of radius 10 cm at its centre is 0.2×10^{-4} T. Find the magnetic field due to this loop at a point on the axis at a distance of 6 cm from the centre. (6,6,3)

5. (a) State and explain Biot-Savart's law. Derive an expression for the magnetic field at a point due an infinitely long straight current carrying conductor using Biot-Savart's law.

(b) State and prove Ampere's Circuital law. Starting from Ampere's circuital law, establish the relation

$$\vec{\nabla} \times \vec{B} = \mu_0 \vec{J}.$$

(c) Define $\vec{B}$, $\vec{M}$ and $\vec{H}$. Establish the relation

$$\vec{B} = \mu_0 \left(\vec{H} + \vec{M} \right).$$ (6,6,3)

6. (a) State the Faraday's law of electromagnetic induction. Show that

$$\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

(b) Show that if the two coils having coefficient of self inductance L_1 and L_2 are mutually coupled together so that the whole of the flux from one coil links with the other, then the mutual inductance between the two coils is given by

$$M = \sqrt{L_1 L_2}.$$

(c) Derive the expression for the energy stored in the magnetic field of an inductor. Find the energy stored in the magnetic field of a 50 mH coil carrying a current of 2 A. (6,6,3)

7. (a) The magnetic field in a region is given by $\vec{B} = 3\hat{i} + 4\hat{k}$ tesla. Calculate the magnetic flux across the surfaces each of area 2 m^2 in

(i) $x - y$ plane (ii) $y - z$ plane (iii) $z - x$ plane.

(b) Write the four Maxwell's equations in an isotropic dielectric medium.

(c) Derive the wave equation for electric field and magnetic field vectors in an isotropic dielectric medium and hence obtain the velocity of electromagnetic wave in this medium. (6,3,6)

Physical Constants:

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

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

$e = 1.6 \times 10^{-19}\ C$

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

[This question paper contains 4 printed pages.]

(17)

Your Roll No.....

Sr. No. of Question Paper : 2334 **IC**

Unique Paper Code : 42171209

Name of the Paper : Industrial Chemistry: Fossil Fuels, Cleaning Agents and Food Additives

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 **six** questions in all.
3. Question No. **1** is compulsory.

1. (a) Differentiate between renewable and non-renewable sources of energy.

   (b) Write the cleansing action of soap.

   (c) Write the composition and uses of producer gas.

P.T.O.

(d) What is the difference between low temperature carbonization and high temperature carbonization?

(e) Define viscosity index. How it can be calculated? (3×5)

2. (a) What is hydrogenation of oil? Why is it needed?

(b) Differentiate between oil and fats.

(c) What are surfactants? Give their classification. (4×3)

3. (a) What are liquid lubricants? Give characteristics of good lubricating oil.

(b) Differentiate between solid and semi-solid lubricants.

(c) Write a note on synthetic lubricants. (4×3)

4. (a) What is synthetic petrol? Describe the Fischer Tropsch process of its manufacture.

(b) Define octane number of automobile fuel.

(c) Write a note on petrochemical propylene oxide. (6,3,3)

5. (a) Give the composition and uses of coal gas.

(b) How is coal gas manufactured? Give its uses.

(c) What are the prerequisites of good metallurgical coke? (4×3)

6. (a) Differentiate between toilet soap and washing soap.

(b) What are solid lubricants? Give their properties and uses.

(c) Write a note on natural and synthetic colors as food additives. (4×3)

7. Write a short note on the following **(any three)** : (4×3)

(a) Soap additives

(b) Artificial sweetners

(c) Catalytic cracking

(d) Fat splitting

[This question paper contains 6 printed pages.]

(18)

Your Roll No.....

IC

Sr. No. of Question Paper : 2335

Unique Paper Code : 42351211

Name of the Paper : Calculus And Matrices

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 any **two** question from each section.

SECTION I

1. (a) Define linearly independent vectors. Is the vectors (1,2,4), (0,1,2), (0,0,1) in $\mathbb{R}^3$ are linearly independent?

(b) Prove that $T : \mathbb{R}^2 \to \mathbb{R}^2$ defined by $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} 2x \\ 2y \end{bmatrix}$ is a Linear Transformation. Describe the effect

of this transformation on a ΔABC with Vertices A(0,0), B(2,0) and C(1,2).

(c) Define a basis of a vector space. Verify that the set

$$S = \left\{ \begin{bmatrix} 1 \\ 3 \end{bmatrix}, \begin{bmatrix} 1 \\ -1 \end{bmatrix} \right\}$$ is a basis of $\mathbb{R}^2$. (4,4,4)

2. (a) Find the inverse of the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 2 & 3 \\ 5 & 5 & 1 \end{bmatrix}$ using elementary row operations.

(b) Find the eigenvalues and eigenvectors of the reflection about x-axis in $\mathbb{R}^2$.

(c) Show that the following system of equations is inconsistent

$$x + y - z = 2$$
$$2x - y + z = 1$$
$$3x - y + z = 0.$$ (4,4,4)

3. (a) Examine which of the following is a subspace of $\mathbb{R}^2$. If it is a subspace, give its geometric representation :

(i) $V_1 = \{(a,b^2) : a,b \in R\}$.

(ii) $V_2 = \{(a,2a) : a \in R\}$.

(b) Reduce the matrix $A = \begin{bmatrix} 1 & -2 & 39 \\ 2 & -3 & 18 \\ 3 & 0 & -13 \end{bmatrix}$ to triangular form and hence determine its rank.

(c) Prove that any subset of a linearly independent set of vectors is linearly independent. (4,4,4)

SECTION II

4. (a) Sketch the graph of $y = 4 - |x - 2|$. Clearly state the transformations used at each step.

(b) According to UN data, the world population in 1998 was approximately 5.9 billion and growing at a rate of about 1.33% per year. Assuming an exponential growth rate, estimate the World Population by end of the year 2023.

(c) Find $\frac{d^n y}{dx^n}$ where $y = (ax + b)^n$. (6,6,6)

5. (a) Define bounded and monotonic sequence. State monotone convergence theorem. Give an example of a sequence which is bounded but not monotonic.

(b) Examine the Convergence of the following sequences :

(i) $\left\{\frac{\cos n}{n}\right\}$ (ii) $(-1)^n$

(c) If $\sin(x+y) = py$, where p is a constant, prove that

$$\frac{d^2y}{dx^2} = -y\left(1+\frac{dy}{dx}\right)^3. \qquad (6,6,6)$$

6. (a) If $y = (\sin^{-1}x)^2$, prove that

$$\left(1-x^2\right)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - 2 = 0.$$

(b) Find the Taylor series generated by $f(x) = \frac{1}{x}$ at $x = 2$. When does this series converge to $\frac{1}{x}$?

(c) Describe the surface represented by $z = 16x^2 - 9y^2$. (6,6,6)

SECTION III

7. (a) Let z_1, z_2, z_3 be affixes of points P, Q, R respectively. If $|z_1| = |z_2| = |z_3|$ and $z_1 + z_2 + z_3 = 0$, prove that ΔPQR is equilateral.

(b) Find the equation of the circle whose radius is 3 and whose centre has affix $1 - i$. (3.5,4)

8. (a) Find the equation whose roots are nth power of the roots of the equation

$$x^2 - 2x\cos\theta + 1 = 0.$$

(b) Solve the equation $z^6 + z^3 + 1 = 0$. (3.5,4)

9. (a) State Fundamental theorem of Algebra. Form an equation in lowest degree with real coefficients which has $1+\sqrt{2}$ and $2-\sqrt{3}$ as two of its roots.

(b) Prove that :

$$\left(\frac{1+\sin\emptyset+i\cos\emptyset}{1+\sin\emptyset-i\cos\emptyset}\right)^n = \cos\left(\frac{n\pi}{2}-n\emptyset\right)+i\sin\left(\frac{n\pi}{2}-n\emptyset\right).$$

(3.5,4)

[This question paper contains 4 printed pages.]

(19) **Your Roll No.....2019**

Sr. No. of Question Paper : 2336 IC

Unique Paper Code : 42231202

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

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. Question No. **1** is compulsory
3. There are **two** sections, **Section A** and **Section B.** Attempt **two** questions from each section.
4. Attempt **five** questions in all.
5. Draw neat labelled diagrams wherever necessary.

1. (a) Define the following terms : (5)

   (i) Ontogeny

   (ii) Neopalium

   (iii) Primitive streak

   (iv) Plastron

   (v) Vitellogenesis

P.T.O.

(b) Differentiate between following pairs of terms **(any five)** : (2×5)

(i) Larynx and Syrinx

(ii) Epiboly and Emboly

(iii) Spermatogenesis and Spermiogenesis

(iv) Epitheliochorial and Haemochorial placenta

(v) True horns and Antlers

(vi) Ductus caroticus and Ductus botalli

(c) Give location and function of the following : (4)

(i) Acetabulum

(ii) Sertoli cells

(iii) Carnassial tooth

(iv) Jacobson's organ

(d) Match the following : (4)

A	B
(i) Acrosome	(a) Heart
(ii) Ceruminous gland	(b) Sperm
(iii) Foramen ovale	(c) Blastula
(iv) Fate map	(d) Sweat gland

(e) Name the germ layers from which the following are derived : (4)

(i) Notochord

(ii) Artery

(iii) Adrenal cortex

(iv) Testes

SECTION – A

2. (a) Explain the succession of kidney in vertebrates. Support your answer with suitable diagrams.

(b) Write in brief about various types of uteri in mammals. (8+4)

3. (a) What are receptors? Classify them with suitable examples. (6+6)

(b) Briefly describe the structure and mechanism of respiration in birds.

4. Write brief notes on **any three** of the following: (4+4+4)

(a) Visceral arches

(b) Pancreas

(c) Epidermal derivatives

(d) Ruminant stomach

SECTION – B

5. (a) Give an account of development of frog upto gastrulation with the help of labelled diagrams.

(b) Add a note on phenomenon of metamorphosis in frog. (8+4)

6. (a) Describe the various types of morphogenetic movements and their role during mammalian development.

(b) Explain the various phases of oogenesis that form a mature ovum from primordial germ cell. (6+6)

7. Write short notes on **any three** of the following : (4+4+4)

(a) Primary organizer

(b) Types of cleavage

(c) Fate maps

(d) Cortical reaction

[This question paper contains 6 printed pages.]

(20)

Your Roll No.....

Sr. No. of Question Paper : 2337 IC

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** of both sections.
5. Attempt **all** parts of a question together.

SECTION – A

1. (a) Define **any five** of the following terms : (5×1=5)

   (i) Pedogenesis

   (ii) Abundance

   (iii) Heliophytes

P.T.O.

(iv) Edge effect

(v) Megatherm

(vi) Autoecology

(vii) Food chain

(b) Match the following : (5×0.5=2.5)

(i) Ecesis	(a) Total water present in soil
(ii) Weathering	(b) Amount of inorganic substance present at any given time in an ecosystem
(iii) Holard	(c) Instrument to measure light intensity
(iv) Standing state	(d) Process of successful establishment of a species in a new area
(v) Lux meter	(e) Process of breakdown of parent rock material

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

(i) Neoendemism and paleoendemism

(ii) Primary and secondary succession

(iii) Epilimnion and hypolimnion

(iv) Analytical and synthetic characters of community

(v) Capillary water and hygroscopic water

(vi) Pyramid of number and pyramid of biomass

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

(i) Light as an ecological factor

(ii) Phytogeography

(iii) Shelford's law of tolerance

(iv) Hydrosere

4. (a) Write an explanatory note on soil profile with the help of a well labeled diagram. (7)

(b) What are biogeochemical cycles? Discuss nitrogen cycle with the help of a diagram. (8)

SECTION – B

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

(i) Classification proposed by _____ is considered as phylogenetic system of classification.

(ii) The branch of taxonomy based on the information obtained from phytochemical studies is _____.

(iii) _____ is a specimen or illustration designated by the author of the species to represent nomenclatural type of species.

(iv) _____ botanical garden is situated in Bengaluru.

(v) _____ is the father of taxonomy.

(vi) The Flora of British India is written by _____.

(vii) The ICN sets the formal starting date of plant nomenclature at _____.

(b) State true or false for the following : (5×0.5=2.5)

(i) Adanson is the father of numerical taxonomy.

(ii) The annotation label is used to write the corrections done for the original label and is appended to the right side of the herbarium sheet.

(iii) The alternate name for family cruciferae is lamiaceae.

(iv) The head office of BSI is situated at Kolkata.

(v) A clade is a group of organisms that includes a single ancestor and all of its descendants.

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

(i) Artificial and natural system of classification

(ii) Phenogram and cladogram

(iii) Synonym and homonym

(iv) Isotype and neotype

(v) Local flora and regional flora

(vi) Indented (yoked) and parallel key

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

(i) APG

(ii) ICNCP

(iii) L.

(iv) IAPT

(v) Lamk

(vi) *sp. nov.*

(b) Discuss the Principles of ICN. (5)

(c) Explain the role of palynology in taxonomy. (5)

4. (a) Give the merits and demerits of classification proposed by Engler and Prantl. (6)

(b) Interpret **any three** of the following : (3×2=6)

(i) *Delphinium viscosum* Hook.f. *et* Thomson

(ii) *Vallisneria natans* (Lour.) Hara

(iii) *Gossypium tomentosum* Nutt. *ex* Seem.

(iv) *Phyllanthus* Linn. *emend.* Mull.

(c) Identify the taxonomic rank of **any three** of the following : (3×1=3)

(i) Lamiales

(ii) *Triticum*

(iii) Liliaceae

(iv) Magnoliopsida

Sl. No. 07 Q.P. 34477 (21)

Unique Paper Code	:	234291
Name of the Paper	:	Computational Skills (CSAT-201)
Name of the course	:	B.Sc. (~~APS~~)/ B.Sc. (H)Electronics / Comp. Sc.
Semester	:	~~Semester~~-II
Duration of Examination	:	Three Hours
Maximum Marks	:	75 Marks

Instruction for Candidates:

Question No. 1 (in Section A) is compulsory.

Answer any *Five* questions out of the remaining (Q. No. 2 to Q. No. 8) in Section B.

Answer *all* parts of the question together.

SECTION-A

1. Answer the following:

a) VLSL technology is used in _____ generation computers. (1)

b) What is FLASH memory? (2)

c) Why I/O device are necessary for a computer system? (2)

d) Define cache memory. (2)

e) How base of a number system is related with the number of symbols or digits present in that number system? (2)

f) Name two common graphics file formats. (2)

g) Define router. (2)

h) Which register hold the current instruction? (2)

i) Any program is an algorithm, although the reverse is not true. Discuss this statement. (2)

j) Distinguish between word–addressable and character– addressable computers. (2)

k) Dot matrix printer is impact printer, explain the statement. (2)

l) Give full form of (i) FTP (ii) SGML (iii) CAD (iv) GUI. (4)

SECTION-B

2 a) Perform the following conversions: $2 \times 3 = 6$

a. $11001.001_2 = (\ )_{10}$
b. $2AB_{16} = (\ )_2$
c. $43.765652_{10} = (\ )_{16}$

b) Subtract 01100_2 from 010010_2 by using 2's complement method. (4)

3 a) Explain Telnet & Browsers. (3)

b) Differentiate between soft copy & hard copy output with example. (3)

c) Differentiate between Dot Matrix & Inkjet Printers. (4)

4 a) Write an algorithm to determine whether a given number is odd or even. (5)

b) Find out the output of following algorithm: (5)

1. START
2. READ num
3. size = 10, count = 1
4. WHILE count < size
   ans = num * count
   WRITE num, "times", count, "equals", ans
   ENDDO
5. STOP

5 a) What is Internet? Write *four* services provided by Internet and how each of these services helps the Internet users. (5)

b) What are the applications of multimedia in education? (5)

6 a) Explain different types of computers. (5)

b) Differentiate betwwenprimary & secondary memory. (5)

7 a) Which of the following are multimedia devices & why? (3)

a. Book having Text only.
b. A modern personal computer
c. A modern mobile system.

b) Differentiate between CISC and RISC. (3)

c) Draw a block diagram to show the organization of a computer system. (4)

8 Write short notes on any two of the following: 5 x 2 = 10

a. Networks
b. Registers
c. Point & draw devices.

(3)

This question paper contains 3 printed pages

(22)

Roll No. 2019

Sr. No. of Question Paper: 3479

Unique Paper Code: 235267

Name of the Course: B.Sc. (Prog.) ~~(Applied Physical Sciences)/ Analytic Chemistry / Industrial Chemistry~~

I

Name / Title of the Paper: Calculus and Matrices (MAPT-101)

Semester: II

Time: 3:00 Hours

Maximum Marks: 75

(Write your Roll No. on the top immediately on receipt of this question paper)

Attempt any two questions from each Section.

SECTION-I

1.(a) Show that the vectors $\begin{bmatrix}1\\2\end{bmatrix}$ and $\begin{bmatrix}2\\1\end{bmatrix}$ of R^2 are linearly independent. Express the vector $\begin{bmatrix}5\\3\end{bmatrix}$ as linear combination of the vectors $\begin{bmatrix}1\\2\end{bmatrix}$ and $\begin{bmatrix}2\\1\end{bmatrix}$.

(b) Let $W=\left\{\begin{bmatrix}x\\y\\0\end{bmatrix} : x,y\in R\right\}$. Show that W is a subspace of R^3. Give a basis of W. (6, 6)

2.(a) Let $T:R^2\to R^2$ be defined by

$$T\left(\begin{bmatrix}x\\y\end{bmatrix}\right)=\begin{bmatrix}y\\-2x\end{bmatrix}$$

Show that T is a linear transformation. Also find a matrix representation for T.

(b) Show that the vectors $\begin{bmatrix}1\\-2\end{bmatrix}$ and $\begin{bmatrix}1\\0\end{bmatrix}$ are the eigenvectors for the matrix $A=\begin{bmatrix}-1 & -2\\0 & 3\end{bmatrix}$. What are the eigenvalues associated with each of these vectors? (6 , 6)

3. (a) Show that the following system of equations is not consistent.

$$x + y - z = 2$$
$$2x - y + z = 1$$
$$3x - y + z = 0.$$

(b) Find the rank of the matrix using elementary row operations

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 0 \\ 0 & 1 & 2 \end{bmatrix}$$

(6, 6)

SECTION-II

4. (a) Sketch the graph of $y = |x - 2| + 4$. Also mention the transformations used at each step.

(b) Find the n^{th} derivative of $\sin(ax + b)$

(c) A certain culture of bacteria grows at a rate that is proportional to the number present. It is found that the number doubles in 4 hours. How many is expected at the end of 24 hours?

(6, 6, 6)

5. (a) Discuss the convergence of the sequences: (i) $\left\{\frac{(-1)^n}{n^2}\right\}$ (ii) $\left\{\frac{\sin n}{n}\right\}$

(b) Show that $u(x,t) = 4\cos(2x + 2ct) + e^{x+ct}$, is a solution of the wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$.

(c) If $u = \frac{1}{\sqrt{x^2+y^2+z^2}}$, $x^2 + y^2 + z^2 \neq 0$. Show that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = 0$. (6, 6, 6)

6. (a) If $y = \sin(m \sin^{-1} x)$, prove that

$$(1 - x^2)y_{n+2} = (2n + 1)xy_{n+1} + (n^2 - m^2)y_n$$

(b) Find the Maclaurin's series expansion upto five terms of the function $f(x) = e^{2x}$.

(c) Draw the level curves of $f(x,y) = y^2 - x^2$ of height $k = 0, 1$. (6, 6, 6)

SECTION-III

7. (a) State and prove De Moivre's theorem when n is an integer(positive or negative).

(b) Describe the set of point z in the complex plane that satisfy $|z + (1 - i)| = 6$. (3.5, 4)

8. (a) Find the Centre and radius of the circle, whose equation is

$$z\bar{z} + (2 - 3i)z + (2 + 3i)\,\bar{z} + 4 = 0$$

(b) Give the geometrical interpretation of the sum of two complex numbers. (3.5, 4)

9. (a) State the Fundamental theorem of Algebra and hence form an equation of lowest degree with real coefficients that has 3-6i and 3+6i as two of its roots.

(b) If n is a positive integer, show that

$$(\sqrt{3}+i)^n + (\sqrt{3}-i)^n = 2^{n+1}\cos\frac{n\pi}{6}$$

(3.5, 4)

Sl-no of Q-P : 3480 (23)

~~SET – A~~

2019

Unique Paper Code:	**217261**
Name of the Paper:	**Thermodynamics, Equilibria and Functional Group Organic Chemistry – I (Chemistry – II, CHPT -202)**
Name of the Course:	**~~B.Sc. Life Sciences/Applied Life Sciences/ ACPM/ Industrial Chemistry/ ALS/ APS/ ACPT~~** 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. Use of scientific calculators and log tables is allowed.
3. Use **separate sheets** for **section A** and **section B**.

Section A
(Physical Chemistry)

Attempt any three questions in this section. All questions carry equal marks.

1. (a) What are intensive and extensive variables? Give examples.
   (b) At absolute zero, the entropy of pure elements and compounds is zero. Explain.
   (c) Give the Henderson Hasselbalch equation for pH of an acidic buffer.
   (d) What is the difference between open and closed system?
   (e) What is meant by the term **degree of hydrolysis**?

2.5 x 5 = 12.5

2. (a) State and explain the **First Law of Thermodynamics**.
   (b) One mole of an ideal gas at 300 K and 10 atm pressure expands to 1 atm. Calculate w, q, ΔE and ΔH for isothermal and reversible expansion of the gas.
   (c) How ΔG of a chemical reaction is related with ΔS and ΔH? Explain the significance of positive, negative and zero values of ΔG.
   (d) State the Le - Chatelier's principle and predict the effect of increasing temperature and pressure on the following reaction:

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

3. (a) Derive the following relation:

2.5,4,3,3

$$\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$$

   (b) Derive the following relation for the hydrolysis of salt of weak acid and weak base.

$$pH = \frac{1}{2}[pK_a + pK_w - pK_b]$$

(c) Calculate the entropy change for the fusion of one mole of a solid, which melts at 300K. The latent heat of fusion is 2.51 kJ/mol.

3,6,3.5

4. (a) The solubility product of $Pb_3(PO_4)_2$ is 1.5×10^{-32}. Determine its solubility in g/L. (Molar Mass $Pb_3(PO_4)_2 = 811$ g/mol)

(b) Write short notes on the following (any three)

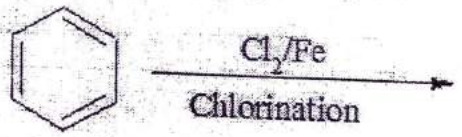
i. Hess's Law of constant heat summation
ii. Ostwald dilution Law
iii. Buffer solution
iv. pH Scale

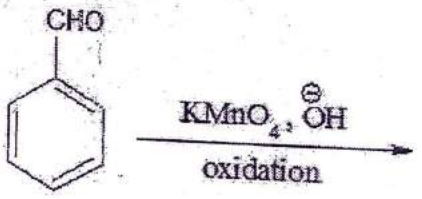
5, 2.5 x 3 = ~~7.5~~

Section B
(Organic Chemistry)

Attempt any <u>three</u> questions in this section. All questions carry equal marks.

5. (a) Complete the following reactions:

i. 

ii. 

iii. $2CH_3CHO \xrightarrow[\Delta]{NaOH(aq)}$

iv. $C_6H_5COCH_3 \xrightarrow{Zn\ (Hg),\ HCl}$

(b) Describe Lucas test to distinguish between primary, secondary and tertiary alcohols.

(c) Explain Cannizzaro reaction by taking a suitable example with its mechanism.

4,4,4.5

6. (a) Give reason for the following:

i. Aryl halides are unreactive towards nucleophilic substitution reaction at mild conditions.
ii. Phenols are weakly acidic in nature.

(b) Give S_N1 mechanism for alkyl halides by taking a suitable example.

(c) Give steps involved in the formation of phenol from benzene by cumene hydroperoxide method.

4,4,4.5

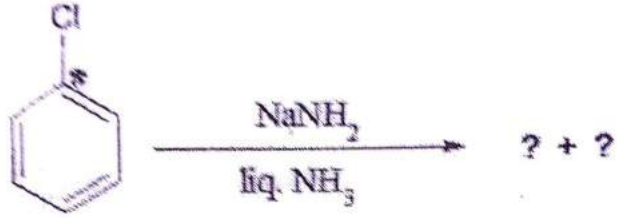
(a) Give a chemical test to distinguish between following pairs:

i. Acetone and acetaldehyde

ii. Acetone and propionaldehyde

(b) Ar-O-R on reaction with HI gives phenol and alkyl iodide rather than aryl iodide and alcohol. Give reason.

(c) Predict the products and give the benzyne mechanism for the following reaction:



4,4,4.5

8. Write short notes on any **three** of the following:

i. Pinacol - Pinacolone rearrangement

ii. Aldol condensation

iii. Williamson's synthesis

iv. Reimer – Tiemann reaction.

4,4,4.5

[This question paper contains 3 printed pages.]

Sr. No. of Question Paper..... 3483 (24) Your Roll No.....2019

Set ~~:~~ C I

Unique Paper Code : 235266

Name of the Paper : CALCULUS AND GEOMETRY (MAPT 202)

Name of the Course : B.Sc. (H) Computer Science/ B.Sc. (Mathematical Sciences)/ B.Sc. (Physical Sciences)

Semester : II

Duration : 3 Hours

Maximum Marks : 75 Marks

Instructions for Candidates

1. Write your Roll no. on the top immediately on the receipt of this question paper.
2. This question paper has six questions in all.
3. Attempt any two parts from each question.
4. All questions are compulsory.

Q1. (a) Prove that $\lim_{x\to 0} \frac{x-|x|}{x}$ doesn't exist. (6)

(b) Use (ε, δ) definition to prove that $\lim_{x\to 2} \frac{x^2-4}{x-2} = 4$. (6)

(c) Define uniform continuity. Show that the function $f(x) = \sqrt{x}$ is uniformly continuous function in [0,1]. (6)

Q2. (a) Verify Rolle's Theorem for $f(x) = x^2$ in [-1, 1]. (6)

(b) Verify Lagrange's Mean Value Theorem for the function

$$f(x) = (x-1)(x-2)(x-3) \text{ in } [1,4].$$ (6)

(c) Separate the intervals in which the following function is increasing or decreasing

$$f(x) = x^3 - 6x^2 + 9x + 1.$$ (6)

Q3. (a) Find the asymptotes of the curve $x^3 + 3x^2y - 4y^3 - x + y + 3 = 0$.

OR

$$r(\pi + \theta) = ae^{\theta}.$$ (6)

(b) Determine the position and nature of the double points of the curve

$$x^2 + 2y - 2x - y^2 = 0.$$ (6)

(c) Sketch the graph of $r = a \sin 2\theta$ in polar coordinates. (6)

Q4. (a) Evaluate $\int_8^{15} \frac{dx}{(x-3)\sqrt{x+1}}$. (6.5)

(b) Trace the curve $y^2(a^2 - x^2) = x^4$. (6.5)

(c) Find the open intervals on which the function $y = 5 + 12x - x^3$ is concave up or concave down. Also the points of inflexion. (6.5)

5(a) Find the area between the parabolas $y^2 = 4a(x + a)$ and $y^2 = -4a(x - a)$. (7)

(b) Describe the graph of the equation:

$$2x^2 + y^2 + \sqrt{3}xy - 10 = 0.$$ (7)

(c) Put the equation in standard form and sketch it:

$$16x^2 + 25y^2 = 400.$$

Also determine the foci. (7)

6(a) Rotate the axes of coordinates to remove the xy-term from the equation:

$$x^2 + xy + y^2 - 3 = 0$$

Then name the conic and sketch the graph. (6)

(b) (i) $F = x^2y\,i + 2zy^3\,j + 3z\,k$. Find curl F. (2)

(ii) Sketch the graph of $x^2 + y^2 = 1$ in 3-space. (4)

(c) A particle moves along the curve $r(t) = e^t i + \frac{2}{9}e^{2t}j$, where t is the time. Find the component of the velocity and acceleration at t = $ln3$. (6)

S. No. of Question Paper: 3496 (25) Roll No. 2019

Unique Paper Code: 216251

Name of the Paper: Biology-II (LSPT-202)

I

Name of the Course: B.Sc. (Hons.)/ B.Sc. (Prog.) ~~Semester: II~~ Semester - II/IV

Duration: 3 Hours **Maximum Marks: 75**

(Write the Roll No. on the top immediately on receipt of this question paper)

Answer **Five** question including **Question No.1** which is compulsory.

1. (a) Expand the following **(any Five):** **5x1=5**
   (i) SEM
   (ii) PPLO
   (iii) MPF
   (iv) ATP
   (v) SER
   (vi) Cp DNA

   (b) Fill in the Blanks **(any five):** **5x1=5**

   (i) ..... is a used as a fixative in Electron Microscopy?

   (ii) 70s ribosomes are found in ..... Cells.

   (iii) ..... is the marker enzyme of mitochondria?

   (iv) ..... is the spontaneous movement of a substance down its concentration gradient.

   (v) ..... are involve in the formation of cell plate.

   (vi) Mitotic spindle is made up of ..... protein.

   (c) Match the following: **5X1=5**

(i) J. D. Robertson	Confocal Microscope
(ii) Benda	Mitosis
(iii) Marvin Minsky	Unit membrane model
(iv) Walter Flemming	Nucleus

(v) Robert Brown Mitochondria

2. Write short notes on the following **(Any Five)**: **5X3=15**

(i) X-ray diffraction

(ii) Freeze fracturing

(iii) Function of Chloroplast

(iv) Binary Fission

(v) Tight junction

(vi) Ribosomes.

3. Draw well labeled diagram of the following **(Any three)**: **3x5= 15**

(i) Ultrastructure of Mitochondria
(ii) Ray diagram of confocal microscope
(iii) Ultra structure of nucleus
(iv) Ray diagram of Fluorescence microscope

4. (i) Briefly describe Endosymbiont theory for Mitochondria. **3x5=15**

(ii) Explain semiautonomous nature of chloroplast.

(iii) Explain the structure of cell wall.

5. Differentiate between the following **(any three)**: **3x5=15**

(i) SEM and TEM
(ii) Active and Passive transport
(iii) Exocytosis and Endocytosis
(iv) Smooth and rough ER
(v) Euchromatin and Heterochromatin

6. (i) Explain the molecular control of Cell cycle. **7.5**

(ii) Why are Lysosomes referred as Suicidal bag? Explain their structure and function in detail. **7.5**

7. (i) Explain with the help of diagram the structure of plasma membrane proposed by Singer and Nicolson. What are the main functions of phospholipids, proteins and carbohydrates in the cell membrane? **8**

(ii) Discuss the sodium-potassium pump involved in the functions of cell membranes? (5)

(iii) What is facilitated transport? **2**